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CONTRIBUTIONS TO THE FLORA OF ALASKA*

A. E. PORSILD, National Museum of Canada

(Plates 461-464)¹

DURING the summer of 1926 the writer made a journey through Alaska, accompanied by his brother, Mr. R. T. Porsild. The trip was made on behalf of the Dominion Government for the purpose of studying the reindeer industry in Alaska, particularly reindeer grazing in different sections of that country and the reindeer industry in relation to the economy of the native population.²

Although botanical collections and field notes were made whenever and wherever time and opportunity permitted, the collecting of plants was purely incidental. For this reason and because the primary objective took up most of our attention, the time which could be devoted to botanizing and to the caring for the collections was always very limited, and in but very few localities were we able to do justice to these pursuits. During the early part of the journey many species, particularly in *Gramineae*, *Cyperaceae* and *Compositae*, were too immature for identification.

The following notes on the flora of Alaska, and the catalogue of species collected or observed in the course of our journey, for the above reasons must of necessity be regarded as incomplete. In view of the paucity of botanical collections, particularly from the interior of Alaska, and especially in view of the comprehensive Flora of Alaska, now in preparation by Dr. Eric Hultén, the writer feels that it

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¹ Illustrations and extra pages published at expense of author.

² A. E. Porsild, Reindeer Grazing in Northwest Canada, Department of Interior Publ. 1929, pp. 1-46.

is justified and desirable, at this time, to make the collection available to the public.¹

A great deal of collecting yet remains to be done before the flora of Alaska may be said to be even tolerably well understood and the mountain regions, particularly those of the Bering Sea and North Alaska, may be counted upon to yield a large number of important finds. That this is so is amply borne out by the fact that our collecting, made hurriedly wherever the principal objective of our journey happened to take us, added so many new records to the flora of Alaska.

In all 648 species, including such subspecies and varieties as appear to have a distinct geographical range of their own, are listed in the catalogue at the end of this paper. Minor varieties or forms having a geographical distribution congruent with that of the species are not included in this figure.

Of these 648 no less than 10 species² and 2 varieties are new to science, 4 are new to the flora of North America, 93 appear not to have been recorded previously from Alaska, 62 have not previously been recorded in Alaska from north of the Pacific coast and the Aleutian chain and 19 were previously known from the Bering Sea region but not from the interior of Alaska.

Of the 648 species and major varieties 27 are *Pteridophyta*, 5 are *Gymnospermae*, 172 *Monocotyledoneae*, 278 *Archichlamydeae* and 166 *Metachlamydeae*.

The catalogue is primarily a list of the plants collected by the writer and his brother and no attempt has been made to include or to discuss in it all species recorded in literature from central Alaska. In the catalogue have been incorporated, however, a number of unpublished records of plants collected by others from the region through which we travelled. The most important of these collections is one of 243 plants made in 1925 by Mr. Hamilton M. Laing of Comox, British Columbia, when a member of the Mt. Logan Expedition, from the St. Elias Range, near the head of Chitina River in S. E. Alaska, in approximate latitude 61° N.³

¹ For a list of the vascular plants of Little Diomed Island, Bering Strait, see A. E. Porsild, Trans. Royal Soc. Can. ser. 3, sect. 5, 33: 21-38 (1938).

Lichens and some mosses were collected also and a list of lichens from Alaska is now being prepared by Mrs. Lucy C. Raup, Jamaica Plain, Mass. A list of the Bryophyta collected on Little Diomed Island was published by Wm. C. Steere, Am. Midl. Nat. 19, 2: 436-439 (1938).

² Of these, *Potamogeton Porsildiorum* Fern. and *Draba exalata* E. Ekm. have been described elsewhere.

³ For an account of the expedition see Can. Alpine Journ. 15: 1-127 (1925). On pp.

Some notes have been incorporated from a collection of plants from Seward Peninsula, Alaska, made over a period of years by Mr. Charles Thornton of Nome, Alaska; also a number of unpublished records have been included, chiefly from the United States National Herbarium, from the region visited by us. No attempt has been made, however, to cite in the catalogue all specimens from the region visited, seen by the writer in the various herbaria visited by him, and the only records added from such sources are such as fill in gaps in his own collection or records of critical species discussed in the text.

Our collection totals 1730 numbers of vascular plants with a total of 8000 sheets. A complete set including all types and unicates, is deposited in the National Herbarium of Canada, Ottawa.

ACKNOWLEDGEMENTS

The writer wishes here to express his sincere gratitude to a number of people who in one way or another greatly assisted in this work. First of all to his brother, Mr. R. T. PORSILD, to whose untiring efforts and keen enthusiasm it is due that, often in the face of great difficulty and adverse conditions, it was possible to bring back so large and representative a collection from a region botanically largely unknown.

To his father, Dr. MORTEN P. PORSILD, Director of the Danish Arctic Station, Disko, Greenland, the writer is particularly indebted, not only for his untiring and stimulating interest in the progress of the work and for many valuable suggestions, but above all for the painstaking compilation and preparation of a manuscript pocket flora, containing brief descriptions and keys to all species which, previous to 1926, had been reported from arctic and boreal northwest America. This pocket flora, in two volumes, proved of immense value in the field, when, due to the great difficulties of transportation, none but the most indispensable handbooks could be carried.

To the late Dr. M. O. MALTE, Chief Botanist, National Museum of Canada, the writer is indebted for much valuable advice and for his unflinching encouragement.

To Dr. R. M. ANDERSON, Chief of the Division of Biology, National Museum of Canada, the writer is grateful for much encouragement and for supplying valuable information about northwest Alaska.

To Mr. L. J. PALMER, United States Biological Survey, Juneau, Alaska, formerly Biologist in charge of Reindeer Grazing Investiga-

99-114 Mr. Laing under "Wild Life of the Upper Chitina" makes a number of observations on the vegetation.

tions, with headquarters at Fairbanks, Alaska, the writer is indebted for generous hospitality while at Fairbanks and for much valuable advice. The writer spent about one month with Mr. Palmer and accompanied him on a number of field trips. During these Mr. Palmer freely placed his intimate knowledge of the reindeer industry, grazing problems and local conditions in general at the disposal of the writer.

To Mr. CHARLES THORNTON, United States Commissioner and Mining Recorder, Nome, Alaska, and a keen and enthusiastic collector of plants, the writer wishes to express his gratitude for being permitted to examine and make use of his important collection of plants from the vicinity of Nome.

To the curators and staffs of a number of herbaria, notably the Gray Herbarium, Harvard University, Cambridge, Mass., the herbarium of the Arnold Arboretum, Jamaica Plain, Mass., the United States National Herbarium, Washington, D. C., New York Botanical Garden, Bronx Park, New York, and the Botanical Museum of the University of Copenhagen, the writer is deeply indebted for making their material of Alaska plants available for study.

The writer particularly wishes to thank Professor M. L. FERNALD and Mr. C. A. WEATHERBY of the Gray Herbarium for checking nomenclature and for many helpful suggestions and much stimulating encouragement during several prolonged and most profitable visits to that institution. To Dr. HUGH M. RAUP of the Arnold Arboretum the writer is indebted for numerous suggestions and for critically reading the manuscript.

The writer further wishes to express his appreciation to the following botanists who have examined or determined critical genera in the collection. Mrs. AGNES CHASE, United States National Herbarium (*Poa leptocoma* and *gaspensis*), Dr. CARL CHRISTENSEN, Copenhagen (*Polypodiaceae*), the late Dr. H. DAHLSTEDT, Stockholm (*Taraxacum*), the late Mrs. ELIZABETH EKMAN (*Draba*, part of collection only), Professor M. L. FERNALD, Gray Herbarium, Harvard University (*Potamogeton* and *Arnica*), Dr. B. FLÖDERUS, Stockholm (*Salix*), Professor MARIE-VICTORIN, University of Montreal (*Lycopodium*), Dr. HUGH M. RAUP, Arnold Arboretum, Harvard University (*Salix* and *Betula* in part), and Professor G. SAMUELSSON, National Herbarium, Stockholm (*Luzula* and *Epilobium*, part of collection).

ITINERARY OF EXPEDITION

The party left Ottawa May 20th, 1926, for Seattle, Washington, where passage was booked on the S. S. Yukon. On June 5th we landed at Seward, the main port of entry to the interior of Alaska and the southern terminus of the Alaska railroad.

Enroute to Fairbanks a few days were spent at Broad Pass in the Alaska Range in order to observe a small reindeer herd brought there from Goodnews Bay in the Kuskokwim district of southwest Alaska, by the United States Government for experimental purposes.



BROAD PASS, June 8-11

We got off the train at a place locally known as Cantwell which consists merely of half a dozen log cabins and a railroad shed. It is situated in the Broad Pass Valley, a short distance south of the extreme east corner of Mount McKinley National Park, in latitude $63^{\circ} 26' N.$ and longitude $149^{\circ} W.$, just north of the divide 2100 feet above sea level.

The west side of the valley is treeless while the eastern side carries a mixed forest of *Picea glauca*, *Betula papyrifera* var. *neo-alaskana* and *Populus tacamahacca*. Along a small river were thickets of *Alnus*

crispa with a number of species of willow amongst which was noted *Salix alaxensis*.

The forest floor in most places was formed of a heath composed of *Betula glandulosa*, *Potentilla fruticosa*, *Vaccinium uliginosum* and *V. Vitis-Idaea*, *Rhododendron lapponicum* and *Ledum groenlandicum*. Coming from the moister south slope of the Alaska Range the total absence of wood ferns was very noticeable. Instead we found a rather xerophytic flora in which the most common species were *Lycopodium annotinum*, *L. clavatum* and *L. complanatum*, *Equisetum arvense*, *Festuca brachyphylla*, *Hierochloë alpina*, *Calamagrostis canadensis*, *Carex atosquama* and *C. angarae*, *Luzula multiflora*, *Cerastium Beer-inghamianum*, *Stellaria longipes*, *Draba glabella* and *Dr. aurea* and, to our great surprise, in tall spruce woods *Eutrema Edwardsii*, which we were accustomed to think of as a high-arctic species; also *Saxifraga tricuspidata*, *Rubus Chamaemorus* and *R. acaulis*, *Astragalus frigidus* var. *littoralis*, *Lupinus arcticus*, *Empetrum nigrum*, *Pyrola grandiflora* and *P. secunda* var. *obtusata*, *Linnæa borealis*, *Antennaria isolepis*, the latter not before recorded from Alaska, and *Artemisia hyperborea*. In the drier places the forest floor was covered with a thick carpet of cladonias.

In wet places near a small brook we collected, for the first and only time during the expedition, *Adoxa Moschatellina*, not previously recorded from Alaska. Here also grew *Anemone Richardsonii*, *Rhodiola integrifolia* and *Cardamine purpurea*.

UPLAND BENCHES

From the valley several miles broad, the mountains on either side rise in a series of curious terraces, no doubt formed, following the successive retreats of the glacier, by river erosion through a thick mantle of glacial gravels of great magnitude. The terrace slopes are densely forested while the benches are essentially treeless and covered with a rather wet, meadow-like tundra. Isolated clumps of spruce, accompanied by willow and alder, are found only where small mountain streams have cut through the terraces.

On these benches the vegetation was less advanced than in the valley or on the upper slopes. Grass-like species predominate but few were sufficiently far advanced for collecting. *Arctagrostis latifolia*, *Hierochloë alpina*, *Eriophorum opacum* and *E. Scheuchzeri*, *Carex rariflora* and *C. saxatilis* and *Luzula confusa*, however, were readily

identified. Low willows and prostrate *Betula glandulosa* were also common. One of the most conspicuous plants of the wet benches, at the time of our visit, was *Polygonum Bistorta*, the pretty, pink spikes of which stood up ten or twelve inches above the ground. Fairly common also were *Claytonia sarmentosa*, *Cardamine purpurea*, *Eutrema Edwardsii*, the latter already in fruit, whereas in the spruce forest in the valley it had been in flower. Of saxifrages, *Saxifraga hieracifolia*, *S. Hirculus*, and *S. punctata* were equally common while *Parnassia Kotzebuei* and *Chrysosplenium tetrandum* were seen but occasionally, the latter already with mature seed. *Rubus Chamaemorus* was common here as elsewhere and so were *R. acaulis* and *Potentilla fruticosa*. Of the *Leguminosae* only *Astragalus alpinus* and *Hedysarum alpinum* var. *americanum* were seen. *Epilobium latifolium* and young plants of *E. davuricum* were common in sandy places. Members of the heath family were rather scarce, represented chiefly by *Cassiope tetragona*, *Vaccinium Vitis-Idaea*, *Oxycoccus microcarpus* and *Ledum decumbens*. Near a brook the exquisite *Dodecatheon frigidum* was just coming into bloom. In wet heath we also saw *Pedicularis Langsdorffii*, *P. capitata*, *P. sudetica* and *P. labradorica*. Very few of the *Compositae* were out and but two, *Petasites frigidus* and a *Taraxacum*, were common.

ALPINE SLOPES

The flora of the valley bottom and the terraces had been a curious mixture of boreal and arctic species, but above 3,000 feet the arctic-alpine flora dominated. On many of the slopes solifluction appeared to be of common occurrence and in some places land slides had descended all the way to the valley floor, carrying with them masses of vegetation. Evidence of solifluction, some of even greater magnitude, had been in evidence in many places along the railroad through the Alaska Range.¹

On the upper slopes on dry, gravelly ridges grew *Festuca brachyphylla*, *Elymus innovatus*, *Lloydia serotina*, *Zygadenus elegans*, *Salix reticulata* and *S. pseudopolaris*, *Polygonum Bistorta*, *Arenaria macrocarpa* and *A. verna* var. *pubescens*, *Draba nivalis*, *Dr. lanceolata* and the Cordilleran *Dr. densifolia*, not previously recorded from north of Alberta. Common also were *Potentilla uniflora*, *Dryas octopetala*, *Arctostaphylos alpina*, *Diapensia obovata* and *Androsace Chamaejasme*.

¹ See Stephen R. Capps, The Kantishna Region, U. S. Geol. Surv. Bull. 687, reference on pages 66-70, Washington 1919.

Numerous large snow drifts still remained on the upper slopes, supplying abundance of moisture to herb-mats and alpine meadows. In such places we saw *Anemone narcissiflora*, *Ranunculus nivalis*, *Parrya nudicaulis*, *Draba aurea*, *Boykinia Richardsonii*, *Androsace septentrionalis*, *Gentiana glauca* and *Pedicularis Langsdorffii*.

On a rocky crag near the summit we added two species to our list, both new to Alaska. They were *Erigeron radicans* and *Antennaria subcanescens*.

GOLDSTREAM CREEK AND PEDRO DOME, June 13th

From our temporary headquarters at Fairbanks several profitable excursions were made by motor car in the vicinity. One, to the hills north of Fairbanks was of particular interest. A narrow, winding road for some distance followed the valley of Goldstream Creek. In the creek-bed a couple of gold dredges were in operation and the valley floor in most places had been disturbed by their operation. A couple of small ponds yielded rich returns of aquatic plants, including *Potamogeton pusillus*, *P. tenuifolius* and a new species, recently described as *P. Porsildiorum* Fernald; in addition *Ranunculus Purshii* ssp. *yukonensis* and *Callitriche verna*. The ponds all teemed with animal life, including frogs, water beetles and several kinds of *Crustacea*.

After a steep climb through dense spruce woods the road finally reached the plateau, where, about 40 miles from Fairbanks, at an altitude of 2,600 feet, we stopped to collect. The low, rounded hills appeared to be covered by glacial till through which protruded bosses of soft schists. On the cliffs we noticed *Dryopteris fragrans*, *Cystopteris fragilis*, *Hierochloë odorata*, *Carex glacialis*, *Artemisia arctica*, *Antennaria alaskana* and *Crepis elegans*, the latter not heretofore recorded from Alaska.

The rather dry, wind-swept, treeless plateau was covered by a low but dense heath composed chiefly of *Betula glandulosa*, *Empetrum nigrum* and *Vaccinium uliginosum*. Here and there in the heath were low, prostrate cushions of white spruce. Scattered irregularly over the plateau were semi-barren gravel plains, apparently too sterile to support a closed heath formation. Here grew in great abundance *Tofieldia nutans*, new to the interior of Alaska, *Lycopodium Selago*, *Salix phlebophylla*, *Empetrum nigrum*, *Diapensia obovata*, *Loiseleuria procumbens* and *Campanula lasiocarpa*.

Below the summit of Pedro Dome, sheltered from the effect of the wind, the upper slopes were covered with an open, park-like forest in which the dominant trees were white spruce and paper birch. The soil here was sandy but, nevertheless, supported a comparatively rich forest flora. Here for the first time, in addition to *Lycopodium annotinum*, *L. clavatum* and *L. complanatum*, we saw *L. obscurum*. Other dominant species were *Spiraea Beauverdiana*, *Cornus canadensis*, *Lupinus arcticus* and *Salix Bebbiana*. Of less importance, but also in full bloom, *Corydalis sempervirens*, *Pyrola grandiflora* var. *canadensis*, *Arnica Louiseana*, the last two not heretofore recorded from Alaska, and *Antennaria isolepis*.

PICEA MARIANA SWAMPS, June 14

Travelling east along Richardson Highway we spent an afternoon collecting in the low, muskeg-covered flats of the Tanana Valley. The dominant species of the lower ground was *Picea mariana*, 20 to 30 feet high, with a dense undergrowth of *Alnus crispa*, *Salix Bebbiana*, *S. myrtillofolia* and other willows, *Ledum groenlandicum*, *Chamaedaphne calyculata* and other ubiquitous heath species.

In one or two places, where recent road construction had cut through the top soil, we noticed that the humus layer in the muskeg was comparatively thin and that no true peat deposits existed. The subsoil everywhere appeared to be alluvial clays and loam, here and there with beds of water-transported gravels.

In low places occupying former river channels occurred the usual marsh vegetation in which *Carex rostrata*, *Eriophorum angustifolium* with *Equisetum limosum* and *Iris setosa* were the dominants. In addition we saw *Geocaulon lividum*, which later proved to be common in the interior, and *Equisetum palustre*, *Carex aurea*, *C. disperma*, *C. concinna* and *C. leptalea* and *Ranunculus Macounii*, the last six all new to Alaska.

Along a low, calcareous ridge which crossed the bog, carrying an open growth of *Populus tacamahacca* and *P. tremuloides*, we saw a number of orchids, amongst which were *Habenaria hyperborea* and *H. obtusata*, *Spiranthes Romanzoffiana*, *Goodyera repens*, *Corallorrhiza trifida* and *Listera borealis*, the last also new to the flora of Alaska. Other interesting species, the last two likewise new to the flora, were *Pyrola chlorantha*, *Erigeron elatus* and *Antennaria anaphaloides*.

NENANA VALLEY, June 18-21

On June 17 my brother had gone down the Yukon to attend a reindeer round-up in the Kokrines Mountains where he spent the latter part of the month and the first week of July, later to join me again at Pastolik on the coast. At the time of our visit to the Broad Pass region the season had been too early for a number of species so, when an opportunity presented itself for a second visit, the writer went south on the Alaska Railroad, this time to Healy at the north end of Broad Pass, just east of Mt. McKinley National Park.

The slopes of the Nenana Valley west of Healy are covered by a thick mantle of till through which few outcrops of schists and gneisses are seen. To the east of the river the formation changes to one of high bluffs of sandstone and shale containing numerous beds of lignite.

The vegetation of the benches west of Healy is very similar to that of the terraces at Broad Pass, except, perhaps that on the whole it appears to be more xerophytic. On low, windswept ridges I saw *Selaginella sibirica*, and, at much lower levels than at Broad Pass, *Elymus innovatus*, accompanied by *Agropyron latiglume* and *Bromus Pumpellianus*.

Outside the river valley water is rather scarce and from a point 2000 feet above the river but few brooks and lakes could be seen. A spring with beautifully clear and cold water issued at the foot of one of the upper benches and along its course a varied and quite luxuriant vegetation was found. Amongst tall white spruce and poplars grew *Boschniakia rossica*, parasitic on the roots of spruce and alder. On the forest floor also were *Dryopteris austriaca* and *Dr. Linnaeana*, *Cystopteris montana*, the latter not known heretofore from Alaska outside of Seward Peninsula. There were also *Botrychium Lunaria*, *Corallorhiza trifida*, *Orchis rotundifolia*, *Trientalis europaea* and many others. In wet moss by the spring grew *Selaginella selaginoides*, *Habenaria obtusata* and *H. hyperborea*, *Arcnaria humifusa*, *Pinguicula vulgaris* and *Primula egaliksensis*. On a gravelly slope near the spring I saw the sweet-scented *Elacagnus commutata* and *Hedysarum Mackenzii*, both new to the flora of Alaska, and *Shepherdia canadensis*.

MOUNTAINS BETWEEN HEALY AND MOODY CREEKS, June 19-20

Time did not permit an ascent of some of the high mountains of the region and I had to content myself with climbing a peak well over 4000 feet high, northeast of Healy. Walking along the wooded lower

slopes was tiresome because of a luxuriant *Vaccinium-Ledum* heath growing in an almost knee-deep, soft, moist sphagnum carpet in which grew *Oxycoccus microcarpus* and *Pinguicula villosa*, *Andromeda Polifolia*, *Tofieldia palustris*, *T. coccinea* and others. In a ravine or small mountain valley which I followed for a short distance was found a mesophytic forest of *Populus tacamahacca* and *P. tremuloides*, *Betula papyrifera*, *Alnus crispa*, *Salix alaxensis* and *S. arbusculoides*, *Cornus stolonifera* and *Viburnum pauciflorum*. In mosses on the forest floor grew *Ranunculus lapponicus*, *Anemone Richardsonii*, *Cornus canadensis*, *Pyrola minor*, *Polemonium acutiflorum* and many others. Leaving the forest, which on the south slopes reaches to 3,000 feet,¹ a gravelly ridge was followed to the top.

On the dry, shaly slope, through which outcrops of shale protruded, *Dryas octopetala* perhaps was dominant, with *Carex obtusata*, *Luzula confusa*, *Potentilla uniflora* and *Oxytropis podocarpa*. In shady crevices of rock grew *Cystopteris fragilis* and *Saxifraga oppositifolia*.

The climb had not been difficult but very tiresome because of the oppressive heat and the unbelievable number of mosquitoes and black flies but, upon reaching the moist, alpine slopes near the summit, my labours were abundantly rewarded, for here grew a number of rare plants which I had not seen before and some which I was not to collect elsewhere in Alaska. Rarest and new to the flora of America was *Claytonia Eschscholtzii*, with large, showy white flowers and a strong tap-root as thick as a man's thumb; with it grew small tufts of the shiny-bristled *Eriophorum callitrix*, in Alaska previously recorded only from Port Clarence, Seward Peninsula, and *Carex atrofusca*, also much beyond its previously known range. Other interesting species of the alpine slopes were *Kobresia bipartita*, *Habenaria obtusata*, *Boynkinia Richardsonii* and *Eutrema Edwardsii*. On gravelly places grew *Arenaria macrocarpa* and *A. arctica*, *Oxyria digyna*, *Oxytropis pygmaea*, *Saxifraga Hirculus* var. *alpina*, *Primula egalikensis*, *Androsace Chamaejasme*, *Pedicularis capitata* and *Antennaria subcanescens*.

Night overtook me on the summit and for several hours it was too dark to collect. When looking for a suitable shelter to rest for a few hours I walked between some large rocks near the summit. Turning a corner I almost stepped on a very large, brown animal. My heart

¹ Capps, l. c., on p. 15 states that the timber in the Kantishna region, generally speaking, is limited to areas below 3,000 feet, but that he had seen single trees (presumably spruce) at an elevation of 3,700 feet.

stopped for a fraction of a second when I remembered the numerous yarns about the ferocious grizzly bears of the Alaska range. My host at the roadhouse at Healy had regaled me the night before with these tales in his endeavour to make me carry his heavy army rifle. Suspecting that he had been "pulling my leg" I had courteously, but firmly, declined and now was unarmed, save for my large hunting knife used for digging plant specimens. The situation, which at first had seemed desperate, unexpectedly solved itself when the "monster grizzly" reluctantly parted into eight fat, grunting porcupines that had been feasting on the dried-up remains of a mountain sheep.

At 2 a. m., refreshed by a short sleep, I again took up the collecting, adding many more specimens to the contents of my already bulging vasculum. The early morning hours were unforgettable. Through a thin mist the sun rose over the glacier-capped peaks of Cathedral Mountain and Mt. Hayes to the east, while to the west Mt. McKinley in its 20,000 foot majesty towered supreme above the mist, tinted pale rose by the early rays of the rising sun.

RICHARDSON HIGHWAY

From June 24 to 28, in the company of Mr. Palmer of the Biological Survey, a trip was made by motor car over the then recently opened Richardson Highway between Fairbanks and the seaport Valdez, at the head of Prince William Sound. For about 75 miles the road follows the north and east bank of the Tanana River through much the same type of country as that visited on June 14th. At McCarty, near its junction with Delta River, we crossed the Tanana by a primitive cable ferry and then followed the east bank of the Delta River. For what seemed endless miles the road crossed an almost level, sandy plain covered by scrubby white and black spruce, paper birch and larch. Save for the rough, sandy road and the almost straight line of three-legged telegraph poles nothing broke the monotony.

Along the roadside where recent road construction had disturbed the native vegetation the exposed sandy loam of the plain supported a rank growth of grasses and weeds. Some were indigenous but evidently brought here with native hay, while others obviously were introduced with fodder imported for the horses used by the road-crews, but now rapidly becoming established. Along the highway we saw in such places *Agropyron Smithii*, *Bromus Pampellianus*, *Avena sativa*, *Hordeum jubatum*, *Phleum pratense*, *Deschampsia cespitosa*, *Calama-*

grostis inxpansa, *Trifolium hybridum*, *Gentiana procera*, new to the flora of Alaska, and *Senecio lugens*.

Whether or not the ground on the level plain was permanently frozen could not be ascertained, but the universal use, here as elsewhere in central Alaska, of the tripod type of telegraph pole, strongly suggests the presence of permanent frost close to the surface.

Fifty miles south of McCarty we left the level plain and began to climb the northern spurs of the Alaska Range. The gentle slopes that here had the appearance of a system of old moraines or eskers bore a monotonous *Picea mariana-Larix laricina* muskeg, not very different from that of the flood plain, while the higher ridges were largely treeless and covered by a luxuriant heath composed chiefly of *Ledum groenlandicum*, *Chamaedaphne*, *Deschampsia cespitosa* and tussocks of *Eriophorum opacum*. Numerous small pothole lakes or ponds occurred in the heath and were fringed by *Carex rostrata*, *Carex physocarpa*, *Eriophora* and *Equisetum limosum*. A few shallow lakes of a different type, with shallow sandy or muddy shores that probably dried out completely during the summer, were also seen. A yellow margin visible even at considerable distance surrounded these lakes and upon close inspection proved to be masses of flowering *Ranunculus reptans*. Near the water's edge we found the rare *Subularia aquatica*, new to central or northern Alaska, and *Alopecurus aequalis* var. *natans*, both in flower. Curiously enough we saw no *Hippuris vulgaris*.

The drive through the mountains was unforgettable. The road had just recently been opened to through traffic but signs warned the traveller to carry shovel and rope and to proceed at his own risk. In one place the road for a distance of six miles merely consisted of a narrow shelf 200 feet above the river, dug into the side of a gravel scree. Meeting another car here involved the excavation of a niche to permit the other car to pass.

PAXON, *June 26th*

Having crossed the divide we stopped at Paxon about fifteen miles south of the watershed. According to signs along the road the elevation here was 2700 feet above sea-level. On scanning the near hillsides through the field glasses the flora appeared promising and we at once recognized a number of southern types that we had not come across before, showing that we were getting into the mesophytic flora of the

Pacific slope. Most conspicuous were the pretty, purple *Geranium erianthum* and *Heracleum lanatum* six to eight feet tall.

Leaving the car we followed a small creek leading towards a mountain slope to the east. In wet moss along the creek we found large clumps of *Dodecatheon frigidum* and *Gentiana glauca*. The higher parts of the slope were covered with a very dense, but low scrub of ground birch, willow and scattered, stunted white spruce. On bare patches left by a fire ten years ago nothing much grew but the ubiquitous *Epilobium angustifolium*. Above 3,000 feet we saw no timber but instead found moist, verdant alpine meadows showing that the region was one of more abundant precipitation than the north slope.

Common in the alpine meadows were *Poa alpina*, *Carex podocarpa* and *C. macrorhiza*, *Luzula parviflora*, *Thalictrum alpinum*, *Aconitum delphinifolium*, *Sanguisorba sitchensis*, *Epilobium Hornemannii*, *Succisa perennis* and *Veronica Wormskjoldii*. Of particular interest was a dioecious mat-forming *Antennaria* which proved to be undescribed. Here and there in low birch thickets we saw large clumps of tall *Potentilla glaucophylla*, similar in habit and appearance to the Greenland endemic, *P. Ranunculus*, and not before recorded from Alaska; also *Ranunculus nivalis*, *Myosotis alpestris* var. *asiatica*, *Draba aurea*, *Viola biflora* and *V. Langsdorffii*.

A heavy downpour accompanied by fog prevented us from exploring the upper slopes. As we returned over the divide the rain stopped and we were again able to enjoy the grandeur of the scenery around Isabella Pass and Summit Lake. While doing that we nearly came to grief. The prolonged spell of hot weather which on one day at Fairbanks had sent the thermometer to 104° F. had caused exceptional swelling of the glacier-fed streams and one boisterous torrent had cut a 200-foot gap through the roadway. Retracing our course for a quarter of a mile we now saw a detour sign, scribbled in pencil on an empty milk box. The detour necessitated several crossings of turbulent, but luckily quite shallow glacial streams and, with one of us walking ahead to sound the depth of the water, we managed to get across safely with only the running-boards of the car awash.

Darkness overtook us at Miller, near a place where Castner Glacier reaches within a mile or two of the road. This place we had picked out the day before as the most "alpine" one seen along the road and one that promised a profitable day of botanizing.

CASTNER GLACIER, June 27.

The weather looked promising the next morning so we got away to an early start following the glacier-stream in search of a ford. A few attempts soon convinced us, however, that the stream was much too deep and turbulent and, to make matters worse, the swift waters were full of small and large jagged pieces of ice. To reach the mountain it was necessary, therefore, to climb the glacier-tongue.

The alluvial fan near the glacier-tongue showed a rare mass of colour for here grew large clumps of *Epilobium latifolium* in full bloom and in some places patches of the pure white-flowered variety. With them were purple *Hedysarum Mackenzii* and *Aster sibiricus*, and on the higher gravel bars white-flowered *Dryas octopetala* and the magnificent yellow-flowered *D. Drummondii*, also the pale blue-flowered viscid *Oxytropis hudsonica*, the last two new to the flora of Alaska, and deep-blue *Lupinus arcticus*, pink *Silene acaulis* and yellow *Crepis nana*.

The glacier-tongue for a distance of about two miles was covered by moraines and had the appearance of being in rapid retreat. The glacier itself, therefore, was free from crevasses and was crossed without difficulty. On the fresh moraines, near the glacier, we saw *Melandrium apetalum*, *Saxifraga cernua* and *S. oppositifolia*, *Arenaria verna*, the Cordilleran *Cerastium Earlei*, which is new to Alaska, *Draba stenoloba* and *Dr. crassifolia*, both new to the interior of Alaska, and a number of other arctic-alpine species. On a south-facing scree, made fertile by a thick deposit of loess and fine wind-carried, decaying vegetable drift we found a luxuriant growth apparently not in the least affected by the proximity of the glacier.

Here at last we saw ferns in abundance. Most common were *Dryopteris austriaca* and *D. Linnaeana*, *Cystopteris montana* and *C. fragilis*, the last three restricted to moist shaded places; likewise *Botrychium Lunaria*, *Lycopodium annotinum*, *L. complanatum* and *L. clavatum*. The season was yet early for most sedges and grasses, and many were still too immature for study. We did recognize *Poa alpina* and its viviparous form, *Festuca brachyphylla*, *Phleum alpinum*, *Carex macloviana*, *C. angarae*, *C. scirpoidea*, *C. Lachenalii*, *C. Garberi* and the curious *C. capillaris* var. *nana*, with the terminal spikelet gynaeandrous; the last two both recorded from Alaska for the first time. In low birch thickets we saw for the first time *Streptopus amplexifolius* and in addition *Haabenaria hyperborea* and *H. obtusata*,

Corallorrhiza trifida, *Pyrola minor* and many others. On rocky ledges above the slope grew numerous saxifrages, *Rhodiola intermedia*, *Gentiana aleutica*, *Antennaria isolepis* and also the new *Antennaria* from Paxon.

At midnight, with vasculums and packsacks filled to capacity, we returned to our tent. Next morning with deep regret and a wistful look back to Castner Glacier and its many unexplored possibilities we rolled up our tent and blankets. Time did not permit us to remain longer; the river steamer on which we had booked passage to the coast would sail from Nenana on July 1st and much was yet to be done at Fairbanks. Travelling the rest of the day and all next night, making frequent stops along the road to collect, we reached Fairbanks on June 29th. One stop was made at the north end of the pass opposite Rapids Glacier which has recently made itself famous because of its spectacular advance. The glacier-tongue was then barely visible from a low hill east of the road. Two species, both new to Alaska, were added to our collection from there. One was *Carex Williamsii*, growing in wet sphagnum by a brook, while the other, *Erigeron glabellus* var. *pubescens*, we collected on a gravel bar in the river.

COLLEGE AND SMITH LAKE, June 29

A day was spent visiting the recently completed University of Alaska, at College near Fairbanks. It was then known as the "Mining School and Agricultural College of Alaska," and a small suburb had grown up around the university campus. A couple of hours were spent in a small marsh near Smith Lake where a rich flora of marsh and aquatic plants was hurriedly explored. Some of the more interesting species were *Drosera rotundifolia*, *Nuphar variegatum*, *Sparanium hyperboreum*, *Utricularia vulgaris* var. *americana*, *Lysimachia thyrsiflora*, *Scutellaria epilobiifolia* and *Calla palustris*, the last four all new to Alaska. The lake was full of frogs and other aquatic life, while swarms of dragon flies were making but small inroads in the black clouds of mosquitoes that hovered over the marsh.

YUKON RIVER TO THE BERING SEA COAST

On July 1st we embarked for the coast on the S. S. General Jeff. C. Davis, a small and rather obsolete-looking stern-wheeler that plies the Yukon between Nenana and Holy Cross and is all that is left of the once impressive fleet of river boats made superfluous when the rail-

road from Seward to Fairbanks was completed. Although the boat stopped every few hours to load firewood no collecting was done until we reached Holy Cross where a couple of days were spent waiting for the arrival of a small gasoline launch which carried mail and passengers between that place and St. Michaels on the coast.

At the Mission at Holy Cross, for many years maintained by an order of the Russian Orthodox Church, we saw large fields of potatoes almost in bloom and a small patch of oats that looked promising. Other vegetables, including cabbage, carrots, beets, peas and lettuce did well in the Mission gardens.

An afternoon was spent near a small lake. In a wet meadow which bordered the lake grew *Carex rostrata* and tall *Eriophorum angustifolium*, *Arctophila fulva*, *Glyceria grandis* and *G. nervata*, the last two new to the flora of Alaska, also *Thalictrum sparsiflorum* and *Lysimachia thyrsiflora*.

Near the water's edge in a wet cow-pasture grew *Galium tinctorium* var. *subbiflorum*, new to the flora of Alaska, and *Ranunculus Purshii*; in the shallow water *R. trichophyllus* var. *typicus*, *Potamogeton perfoliatus*, *Sparganium minimum* and *S. multipedunculatum*, *Utricularia vulgaris* var. *americana*, *Myriophyllum exalbescens*; and out in the deep water *Nuphar variegatum*.

YUKON DELTA, July 10-14

Several days were spent at Kotlik in the Yukon Delta, weather-bound, with rain and a driving gale from the southwest. The country below Old Andreafski at the head of the delta, 80 miles above Kotlik, had been low and wet and quite devoid of tree-growth. Here at Kotlik the general surface was but a few feet above sea-level, full of shallow ponds and sloughs with stagnant, discoloured and ill-smelling waters. *Sphagnum* forms an important part of the vegetation-cover, while the depressions in the slightly uneven surface are occupied by tall stands of *Carex Lyngbyei* and *Eriophora*. Near the edge of the *Carex* bogs *Galium Brandegei* grows profusely. In meadows occupying former river-channels *Dupontia psilosantha*, *Arctophila fulva*, *Carex rariflora* and *Eriophorum russeolum* are the most important. In the *Sphagnum* we saw the tiny, sweet-scented *Hierochloë pauciflora*. On the higher ground grew *Betula glandulosa* var. *sibirica*, *Ledum decumbens*, *Vaccinium uliginosum*, *Rubus Chamaemorus* and *Empetrum nigrum*, the last two with ripe fruit.

In a shallow lake we managed to fish out a number of aquatic plants including *Sparganium hyperboreum*, *Potamogeton Richardsonii*, *P. vaginatus*, the last new to Alaska, and *Myriophyllum exalbescons*. In floating moss grew the beautiful, white-flowered and very fragrant *Ranunculus Pallasii* and also *Potentilla palustris*.

PASTOLIK, July 16-24

A week was spent attending the rounding up of a large reindeer herd on the tundra at Pastolik between the Yukon Delta and St. Michaels. Low, almost level tundra here extends inland for a distance of 10 or 15 miles, when a low range of volcanic hills is reached. Besides the very characteristic and well developed pattern of irregular polygonal frost ridges ("Strukturboden" or "rutmark") the chief feature of this climaxed tundra is the tussocks or "nigger-heads" which here attain a greater perfection than any I have seen anywhere else. The principal tussock-forming species here, as elsewhere in the region, is *Eriophorum vaginatum* and to a lesser extent also *Scirpus cespitosus* and *Carex lugens*.

Altogether but a dozen or so species dominate the flora and for mile after mile these same species are repeated. *Eriophorum vaginatum*, however, is the preeminent species and nowhere, except in the wettest places would it be possible to lay down a "Raunkiaer circle" without including it. Around the sides and base of the large tussocks formed by this species, some of which are many feet in diameter and attain a height of 4 feet, grow *Ledum decumbens*, *Rubus Chamaemorus*, *Betula glandulosa* var. *sibirica*, *Vaccinium Vitis-Idaea* and *V. uliginosum* var. *alpinum*, and *Spiraea Beauverdiana*, listed in decreasing order of frequency. Very often small, herbaceous species, such as *Thalictrum alpinum*, *Euphrasia mollis*, *Saxifraga Hirculus*, *Stellaria longipes*, *Polygonum Bistorta* and *P. viviparum*, find a congenial place on the peaty sides of such "nigger-heads."

In the bog-filled frost cleavages that occupy the interstices between the "polygon" ridges grow *Eriophorum russcolum* and *E. angustifolium* with a number of species of *Carex*.

The driest parts of the tundra are the "polygon" ridges themselves and the upper edge of the slumping banks of tundra lakes and ponds. Here we find *Empetrum*, *Rubus Chamaemorus*, *Pyrola grandiflora*, *Hedysarum alpinum*, *Rhodiola integrifolia*, *Arctagrostis latifolia*, *Arctostaphylos alpina* and, on the exposed soil facing the pond, *Senecio*

palustris, *Arctagrostis arundinacea* and *Polygonum alpinum* var. *lapathifolium*.

The low tundra perhaps everywhere is resting upon a more or less continuous sheet of solid ground-ice. Where frost action or other agencies have disturbed the protecting surface, "weathering" of the ground-ice immediately sets in and a pond or lake is eventually formed. Such ponds and lakes are always recognizable by the steep, slumping banks in which invariably exposures of solid ice may be seen.¹

The vegetation of the tundra lakes and ponds show the same general paucity of species. *Sparganium hyperboreum*, *Potentilla palustris*, *Hippuris vulgaris* and *Ranunculus Pallasii* are the most common. *Utricularia vulgaris* var. *americana* also is common and on July 21 was in full bloom. Occasional, near the water's edge, are *Caltha natans*, *Epilobium palustre*, *Cicuta mackenziana*, new to Alaska, *Coclopleurum Gmelini*, and, in the water, *Potamogeton filiformis* and its var. *borealis*, and *Callitriche verna*. Sedges are not very abundant although *Carex rostrata* and *C. aquatilis* are by no means rare. Schools of the interesting little Alaska blackfish, *Dallia pectoralis*, were seen in most of these ponds and lakes and are said to winter here, frozen in the mud on the bottom.

The coastal plain is practically level and in a creek near the foot of the hills, more than ten miles from the sea, we saw old drift wood. The hills rise abruptly to a rolling plateau with elevations between 1,000 and 1,500 feet above sea-level. On the steep escarpment facing the tundra grow dense almost impenetrable "islands" of irregular outline composed of low alder bushes. They are conspicuous at a distance by their dark green colour which contrasts sharply with the brownish green of the slope. Due to snow pressure in winter the branches are decumbent or ascending. They sometimes trail down the slope for ten feet or more before the ends of the branches turn upwards. These alder thickets do not cover the slope completely and the observer cannot fail to get the impression of an otherwise stable heath association being invaded by the alder. *Calamagrostis Langsdorffii*, *Equisetum arvense*, and *Cystopteris fragilis* are the only accessory species of importance in the alder thickets. Near the outside fringe, on the roots of the alder, grows *Boschniakia rossica*.

¹ See also: Porsild, A. E.: (1938) Earth Mounds in Unglaciaded Arctic North-western America, Am. Geogr. Journ. 28: 46-58.

On the slope, between the alder "islands," we found a luxuriant form of the usual browse-heath of which the chief components in order of importance, are *Betula glandulosa* var. *sibirica*, *Ledum decumbens*, *Vaccinium uliginosum* var. *alpinum*, *Spiraea Beauverdiana* and *Potentilla fruticosa*.

THE PLATEAU

A more interesting and varied flora was found on the strongly weathered volcanic trap of the plateau. In the coarse gravel we saw *Woodsia glabella*, *Kobresia Bellardi*, *Tofieldia coccinea*, *Salix phlebophylla*, *Arenaria macrocarpa* and *A. arctica*, *Silene acaulis*, *Dianthus repens*, *Saxifraga flagellaris*, *Dryas octopetala*, *Bupleurum americanum*, the very rare *Ligusticum Macounii* and *Phlox sibirica*. On the sides of gentle slopes, where the snow remains late and thus provides abundance of moisture during early summer, we found herb-mats with *Trisetum sibiricum*, *Carex stylosa* and *C. Williamsii*, *Zygadenus elegans*, *Lloydia scrotina*, *Polygonum Bistorta*, *Anemone narcissiflora*, *Aconitum delphinifolium*, *Saxifraga hieracifolia* and *S. spicata*, *Astragalus linearis* which is new to Alaska, *Coclopleurum Gmelini*, *Lagotis Stelleri*, *Arnica Louiscana* and *A. Lessingii*, *Senecio resedifolius* and *Saussurea subsinuata*. Grasses and sedges were both rather poorly represented and neither played an important part in the composition of the herb-mats.

Many of the north slopes of the gently rolling plateau were completely covered with thick carpets of cladonias in which grew an occasional tuft of *Hierochloë alpina* and *Luzula nivalis* var. *latifolia*. Most of the winter pasture of the reindeer herds of the Norton Sound region is found on such plateaus, from ten to thirty miles back from the coast.

ST. MICHAELS, July 25

At St. Michaels is the only harbour for sea-going vessels near the mouth of the Yukon, and for this reason it early gained importance as the gateway to the interior. Of this once important Russian stronghold there now remained but one small watch-tower. During the heyday of gold mining in Alaska at the beginning of the century, ocean freighters here transferred their cargo to the river boats. Decline in mining and finally the opening of the Alaska railroad finished the town. On the beach now lie the rotting hulls of nearly

fifty river boats, some of more than 1,000 tons burden. One of the largest, built in 1901 at a cost of a million dollars, was said to have made but one trip from St. Michaels to Dawson and back but in this one trip had paid for itself.

Time did not permit very much botanizing at St. Michaels but at Qiqertariaq, farther up the bay, we were able to put in a few hours examining some low, volcanic hills in the vicinity of the Eskimo settlement. The flora was very similar to that seen on the hills back of Pastolik although we added a few species not seen at that place; these were *Salix fuscescens*, *S. Seemannii* and *S. cuneata*, *Anemone Drummondii*, *Smolowskia calycina* var. *integrifolia*, *Saxifraga reflexa*, *Eritrichium aretioides* and *Pedicularis verticillata*.

On low, rather wet meadows, between the hills and the lagoon, and on old, stable dunes a varied and interesting littoral flora was met. Deserving special mentioning here were *Poa emmens*, *Carex Gmelini*, *Atriplex Gmelini*, *Koenigia islandica*, *Montia lamprosperma*, *Arenaria peploides* var. *major*, *Sagina intermedia*, *Stellaria humifusa*, *Ranunculus Cymbalaria*, *Lathyrus japonicus*, *Ligusticum Hultenii*, *Primula sibirica*, *Lomatogonium rotatum*, *Mertensia maritima*, *Plantago juncoides*, *Galium Brandegei* and *Chrysanthemum arcticum*.

UNALAKLET, July 29-30

Several days were spent near the village of Unalaklet which is the principal reindeer center in Norton Sound. From here an excursion was made to the winter reindeer pasture on the low hills 15 to 20 miles back from the coast, near the edge of the coniferous forest. The ten miles to the foot of the first strong rapids on the Unalaklet river we travelled by motor boat. Eskimo kayaks were brought along for the return trip and the motor-boat returned at once.

Crossing several miles of low, uninteresting heath and moorland we reached the partly timbered hills that in a series of terraces rise to an elevation of about 2,000 feet. The lower slopes carry a fine stand of white spruce while the terraces are treeless. Much of the forest floor was covered with almost pure stands of *Cladonia sylvatica* in which grew the tall and handsome *Festuca altaica*. Near a brook we saw, for the first time since we left the interior, *Moneses uniflora* and *Anemone Richardsonii*.

Above 1,500 feet the vegetation became more arctic-alpine and at this altitude and above it, as usual, we found the most interesting

flora. In addition to most of the alpine species seen on the hills at Pastolik and Qiqertariaq, we here added an undescribed *Melandrium* and the rare, yellow-flowered Cordilleran *Draba densifolia*, also collected in the Alaska Range at Broad Pass.

On the return trip some small ponds in the lowland yielded, amongst other species, *Potamogeton gramineus* var. *graminifolius* and *P. tenuifolius*. On old dunes near the lagoon grew the sweet-scented *Salix alaxensis* and the handsome, but fetid, sunflower-like *Senecio Pseudo-Arnica*, also *Papaver Macounii*, with pale yellow flowers 4-5 cm. in diameter, and, in addition, most of the littoral species seen at Qiqertariaq.

NOME, August 6-10

A peculiar zonal distribution of plants is very noticeable at Nome and, indeed, in all places in the Bering Sea region where mountains or hills are found exceeding 1,000 feet in elevation. Below this elevation the lowland is uniformly covered by a wet, marshy tundra everywhere inhabited by practically the same assortment of species. The chief variation which manifests itself when one travels inland, away from the sea-shore, is the increasing ratio of fruticose species over herbaceous ones.

On the hills, on the other hand, above 1,000 feet, a very different and much more varied flora is encountered and it is from here that most of the rare and interesting plants come for which the region is famous, notably the species that are Asiatic or at least most closely related to Asiatic species.

The reason for this zonation may be a climatic one, because in arctic countries, at least during summer, the temperature optimum appears to be found not at sea-level, but at elevations between 1,000 and 1,500 feet, but there are other possible factors to be considered. One is that at least a number of these species are calciphiles and in the strongly weathered and well drained volcanic trap, rich in calcite, so common in the region, perhaps find more congenial soil-conditions than in the acid lowland tundra. Lastly, a large number of the species peculiar to the mountain flora of the region suggest, from their general distribution, that they are old species, with reduced ability to migrate or to compete with the more aggressive species of the lowland. In these unglaciated hills, high above the greatest pleistocene submergence, they may have found a refugium where they have since persisted.

From personal experience, in one or two instances supplemented by the observations of Mr. Charles Thornton of Nome, the writer has selected 88 species which, in the Bering Sea region, appear to be restricted to levels above 1,000 feet. By grouping these according to their general distribution it is found that, roughly speaking, three-fourths are Western-Cordilleran, Bering Sea endemics or essentially Asiatic species transgressing into western America, while but one-fourth are circumpolar, or American species distributed across the continent from the Atlantic to the Pacific coast.

CIRCUMPOLAR, OF ESSENTIALLY SO; 17 species: *Woodsia alpina*, *W. glabella* and *W. ilvensis*, *Cystopteris montana*, *Dryopteris fragrans* and *Dr. Phegopteris*, *Botrychium Lunaria*, *Lycopodium alpinum*, *Selaginella selaginoides*, *Kobresia Bellardi*, *Lesquerella arctica*, *Saxifraga flagellaris* and *S. oppositifolia*, *Loiseleuria procumbens*, *Myosotis alpestris*, *Veronica Wormskjoldii*, and *Erigeron unalaschkensis*.

ESSENTIALLY AMERICAN, KNOWN FROM THE ATLANTIC TO THE PACIFIC COAST; 3 species: *Carex Williamsii*, *Habenaria viridis* var. *interjecta* and *Alnus crispa*.

WESTERN AMERICAN OR CORDILLERAN; 16 species: *Carex podocarpa*, *Zygadenus elegans*, *Arenaria obtusiloba*, *Delphinium scopulorum*, *Anemone Drummondii*, *Pulsatilla multiceps*, *Draba densifolia*, *Boykinia Richardsonii*, *Saxifraga reflexa* and *S. radiata*, *Oxytropis pygmaea*, *Bupleurum americanum*, *Androsace Chamaejasme*, *Penstemon* (?) *procerus*, *Arnica Louiseana*¹ and *Antennaria philonipha*.

ENDEMICS OF THE BERING SEA REGION; 15 species: *Carex nesophila*, *Veratrum album* ssp. *oxysepalum*, *Melandrium macrospermum*, *Delphinium Menziesii*, *Ranunculus Chamissonis*, *Papaver Walpolci*, *Aphragmus Eschscholtzianus*, *Cardamine Blaisdellii*, *Draba exalata*, *Ligusticum Macounii*, *Rhododendron kamtchaticum* ssp. *glandulosum*, *Mertensia Eastwoodae*, *Antennaria alaskana*, *Artemisia senjavinensis* and *A. globularia*.

ASIATIC, TRANSGRESSING INTO WESTERN AMERICA; 37 species: *Selaginella sibirica*, *Trisetum sibiricum*, *Tofieldia nutans*, *Salix cuneata* and *S. phlebophylla*, *Arenaria arctica* and *A. macrocarpa*, *Cherleria dicranoides*, *Dianthus repens*, *Oxygraphis glacialis*, *Cardamine purpurea*, *Smelowskia calycina*, *Parrya nudicaulis*, *Saxifraga bronchialis* ssp. *Funstonii*, *S. Eschscholtzii* and *S. scrpyllifolia*, *Potentilla biflora*, *P. elegans* and *P. uniflora*, *Geum glaciale* and *G. Rossii*, *Oxytropis Mertensiana*, *Viola biflora* and *V. epipsila*, *Diapensia obovata*, *Gentiana algida* and *G. glauca*, *Phlox sibirica*, *Polemonium acutiflorum*, *Eritrichium arctioides*, *Lagotis Stelleri*, *Campanula lasiocarpa*, *Antennaria monocephala*, *Artemisia arctica*, *Arnica Lessingii*, *Senecio resedifolius*¹ and *Saussurea subsinuata*.

¹ Also isolated in Gaspé and Newfoundland.

From Nome one excursion was made to Bluff, about fifty miles east of Nome and several to Dexter Creek and Anvil Hill in the vicinity of Nome. Dexter Creek is the largest of several creeks that have cut through the foothills back of Nome. The creek bottom has been extensively worked over by gold dredges and its natural vegetation is largely destroyed. The flora which is now invading this virgin soil very much resembles that which is peculiar to fresh moraines, near a moving glacier.

On the slopes facing the creek was found a rather dense heath in which *Vaccinium uliginosum* var. *alpinum* is the most important component. With it grew *Salix phlebophylla*, *S. Chamissonis*, *S. rotundifolia*, and an occasional clump of the spectacular, purple-flowered *Rhododendron kamtchaticum* var. *glandulosum*. In moist places in the heath we saw several clumps of the large-flowered *Gentiana algida*. In herb-mats and in willow and alder thickets along the course of a small brook we saw in addition *Cystopteris montana*, *Botrychium Lunaria*, *Lycopodium clavatum* and *L. alpinum*, *Selaginella selaginoides*, *Veratrum album* ssp. *oxysepalum*, *Habenaria viridis*, *Papaver microcarpum*, *Chrysosplenium Beringianum*, *Geum Rossii*, *Gentiana glauca* and *G. propinqua*, *Mertensia paniculata* and *Valeriana capitata*.

On the upper slopes and plateau of Anvil Hill, at an elevation of between 1,000 and 1,500 feet, we found the greatest variety of species, including a number that we had not seen before. Amongst these was a small undescribed *Papaver* with pale yellow or white flowers and perfectly glabrous, somewhat coriaceous leaves. There was also a new *Draba*, recently described as *Dr. exalata* E. Ekm. Further there were *Arenaria arctica* and *A. macrocarpa*, *Cherleria dicranoides*, *Parrya nudicaulis*, *Lesquerella arctica*, *Cardamine Blaisdellii*, *Smelowskia calycina* var. *integrifolia*, *Parnassia Kotzebuei*, *Boykinia Richardsonii*, *Geum glaciale* and *G. Rossii*, *Oxytropis Mertensiana*, known in America only from here, *Arctostaphylos alpina*, *Androsace Chamajasmæ*, *Eritrichium aretioides*, *Myosotis alpestris* var. *asiatica*, *Senecio resedifolius*, *Artemisia senjavinensis* and *Antennaria monocephala*.

A mining dump, abandoned 24 years before, was found completely covered with *Sterocaulon Pascale*, with a few tufts of *Festuca brachyphylla*.

DIOMEDE ISLANDS, *August 14–20*

A week was spent on Little Diomed Island in Bering Strait, half-way between East Cape and Cape Prince of Wales. A list of the plants collected there has been published recently in a separate list (Porsild, l. c., 1938).

PORT CLARENCE

A visit to this place was made on August 24 and a few brief hours were spent collecting plants in the vicinity of Teller Reindeer Station. In the botanical history of Alaska, in point of prominence, Port Clarence perhaps is rivalled only by Unalaska. It was here that Kjellman, botanist to the Swedish Vega Expedition, from August 22 to 26, 1879, made the collection of plants which formed the basis of his classic "*Fanerogamer från Vest-Eskimåernas land.*"¹ In it two hundred and eighty-seven species of vascular plants were listed, a great many of them for the first time in Alaska.

Because of its excellent harbour, perhaps the only good one for large ships north of the Aleuts, the place has been visited from time to time by most expeditions passing through the Strait and numerous small collections have come from here. Next in importance to Kjellman's is that made in 1901 by F. A. Walpole. His excellent collection which includes a number of species not recorded by Kjellman has never been published upon. It is deposited in the U. S. National Herbarium. It was at Teller also that the Amundsen-Ellsworth Expedition landed in the dirigible "*Norge*" after its historic flight over the Pole.

In his field diary, under August 24, 1926, the writer made the following notation: "Season too far advanced, most species have gone to seed and the foliage is turning into autumn colours." The remark is interesting because Kjellman, in 1879, in his list of plants from Port Clarence annotates nearly all species collected by him between August 22 and 26 as being in full bloom, including even such early-flowering species as *Parrya nudicaulis*, *Empetrum nigrum*, *Saxifraga oppositifolia* and *S. nivalis*, *Rubus acaulis* and many species, such as *Aconitum delphinifolium*, *Rosa acicularis*, *Epilobium latifolium*, *E. angustifolium* (sterile), *Selinum cnidifolium*, *Gentiana glauca* (sterile), *Campanula uniflora*, *Arnica alpina*, *Artemisia Tilesii* and a number of others, which Kjellman states were still in bud.

¹ Kjellman, F. R., in *Vega-Expeditionens Vetenskapliga Iakttagelser* 2: 25–60 (1883).

It is not possible of course from phenological observation of two single seasons to postulate a change in climate, but the observations at least show that the season of 1926 must have been at least a full month earlier than that of 1879.

NORTH COAST OF SEWARD PENINSULA

Several places were visited on the north coast, but large collections were made only on the Buckland River at the head of Eschscholtz Bay, chiefly from a place 26 miles above the delta. On the north coast the gently sloping foreland is from five to twenty miles wide and is cut up by shallow erosion-valleys separated by low ridges which generally extend to the coast and terminate in a bluff or low headland. Between the headlands are shallow bays, often enclosing, behind low sandspits, large lagoons into which rivers empty. None of these is of any considerable size, although some are navigable for shallow-draught boats for 10 or 20 miles. The coastal slopes are covered by the usual *Eriophorum-Carex* "niggerhead" tundra.

Along the shore are extensive dunes and old raised beaches inhabited by *Elymus arenarius* var. *mollis*, *Poa eminens* and *P. arctica*, *Festuca rubra* var. *arenaria*, *Carex Gmelini*, *Arenaria peploides*, *Rhodiola integrifolia*, *Artemisia Tilesii*, *Aster sibiricus*, *Taraxacum lateritium* and others.

Back of the lagoons are vast meadow-covered flats that imperceptibly change into heath. Most common in the meadows are *Arctophila fulva*, *Dupontia psilosantha*, *Puccinellia paupercula* var. *alaskana* and *P. phryganodes*, *Carex aquatilis*, *C. glauca*, *C. incurva* and *C. rariflora*, *Eriophorum Scheuchzeri*, *Juncus balticus*, *Koenigia islandica*, *Arenaria physodes*, *Stellaria humifusa*, *Cochlearia officinalis*, *Chrysanthemum arcticum* and *Senecio palustris*.

On the Buckland River, five or ten miles above its mouth, the *Eriophorum vaginatum* tundra imperceptibly changes into heath of the usual *Betula glandulosa*-*Arctostaphylos alpina*-*Ledum-Vaccinium* composition, with a sprinkling of a few accessory herbaceous species, notably *Stellaria longipes*, *Rubus Chamaemorus*, *Senecio frigidus*, *Saussurea angustifolia* and *Pedicularis labradorica*.

BUCKLAND RIVER, Sept. 7-10

Buckland River is a fair sized stream, navigable for river boats to 26 miles above its mouth. We obtained temporary quarters at the

eskimo village Nunatsiaq at the foot of the rapids in the center of the winter range of the Eschscholtz Bay reindeer herds. The broad valley here is fringed by low volcanic hills of which a single knoll, Clem Mountain west of the village, attains an elevation of 1,800 feet. The floor of the valley is low and swampy, with numerous large and small lakes through which the river meanders. Small groves of spruce are found on the upper river but in the vicinity of Nunatsiaq the banks, lakes and streams are treeless but support dense thickets of willow and alder, with a dense undergrowth of *Equisetum arvense*, *Arctagrostis arundinacea* and *Calamagrostis Langsdorffii*. The alders which here grow 20–25 feet high supply practically all the firewood used at the village.

Although the season was far advanced a number of interesting records were added from here. *Zannichellia palustris*, collected in a lagoon near the delta, was new to Alaska. In wet marshes we got, in addition to some of the marsh species common to the region, *Carex tenuiflora*, *C. chordorrhiza* and *Eleocharis acicularis*, all new to Alaska, and, in addition, *Carex vaginata*, *C. Williamsii* and *C. paupercula*, *Luzula Wahlenbergii*, *Stellaria crassifolia*, *Subularia aquatica*, *Sanguisorba officinalis*, *Cicuta mackenzieana* and *Drosera rotundifolia*. Common here, as elsewhere in the district on slumping river and lake banks, were the curious 4-valved *Rorippa barbaraefolia* and *Polygonum alpinum* var. *lapathifolium*.

By the middle of September severe frosts put a stop to further botanizing on land but we found that for some time yet aquatic plants could be collected, through holes cut in the ice, with greater ease than in summer and without being tormented by mosquitoes. Our large collections of aquatics extended the range of nearly all species collected earlier in the summer, including that of the new pondweed *Potamogeton Porsildiorum*. Further additions to the flora of Alaska were *Callitriche autumnalis*, *Myriophyllum alterniflorum* and *Utricularia intermedia*.

By December we had completed the cataloguing and packing of the summer's collections. These were shipped to the railhead at Fairbanks via the dogtrail while we ourselves started on our long sledge journey along to Arctic coast of Alaska for new and "greener pastures" in Arctic Northwest Canada.

INDEX TO MAJOR COLLECTIONS CITED (see map on p. 145)

No. on map	Serial Number	Place and location	Date
FAIRBANKS DISTRICT			
1.	Nos. 106-154	Goldstream Creek and Pedro Dome, 51 miles north of Fairbanks. Elevation 800-2000 ft. above sea-level, 65° N.-147° 30' W.	June 18, 1926
2.	Nos. 155-211	Muskeg 10 miles east of Fairbanks, 64° 45' N.-147° 30' W.	June 14, 1926
3.	Nos. 212-243	Near College, 7 miles west of Fairbanks, 64° 52' N.-147° 50' W.	June 17, 1926
4.	Nos. 593-603	Lake 10 miles west of Fairbanks, 64° 52' N.-148° W.	June 29, 1926
5.	Nos. 376-378	Taylor's Fox Ranch, Richardson Highway, 56 miles east of Fairbanks.	June 26, 1926
ALASKA RANGE			
6.	Nos. 1-105	Broad Pass, elevation between 2140 and 3000 ft. 63° 26' N.-149° W.	June 8-11, 1926
7.	Nos. 244-273	Mountains between Healy and Moody Creeks, 63° 50' N.-148° 40' W. Elevation 2000-4000 ft. above sea-level.	June 19, 1926
8.	Nos. 317-375	Healy on west side of Nenana Valley, 63° 50' N.-149° W. Elevation 1000-2000 ft. above sea-level	June 18, 1926
9.	Nos. 274-316	Nenana Valley near Lignite, 63° 55' N.-149° W.	June 21, 1926
10.	Nos. 379-452	Richardson Highway between Summit and McCarty, 63° 10' to 64° 10' N.-145° 40' W. Elevation 1000-3000 ft. above sea-level.	June 28, 1926
11.	Nos. 453-515	Richardson Highway, Castner Glacier, 63° 25' N.-145° 40' W. Elevation 2000-4000 ft. above sea-level.	June 27, 1926
12.	Nos. 516-571	Richardson Highway between Paxon and Summit, 63° to 63° 20' N.-145° 30' W. Elevation 2000-3000 ft. above sea-level.	June 26, 1926
13.	Nos. 572-592	Richardson Highway, near Paxon, south of divide, 63° N.-143° 30' W. Elevation 2000-3000 ft. above sea-level.	June 27, 1926

No. on map	Serial Number	Place and location	Date
CHITINA RIVER DISTRICT ¹			
14.	Nos.	Head of Chitina River, 61° N.—141° 40' W. Elevations chiefly between 2000 and 4000.	1925
LOWER TANANA AND MIDDLE YUKON RIVER			
15.	Nos. 631-657	Tanana River, Hot Springs, 64° N.—150° 20' W.	June 8, 1926
16.	Nos. 604-613	Yukon River, Birches, 65° 06' N.—153° 30' W.	July 3, 1926
17.	Nos. 614-630	Yukon River, Kokrines, 64° 55' N.—150° 40' W.	July 8, 1926
KOKRINES MOUNTAINS			
18.	Nos. 658-684	Kokrines Mountains, near sulphur springs, 65° 17' N.—154° 30' W. Elevation 800 ft. above Yukon River.	July 6, 1926
19.	Nos. 685-815	Kokrines Mountains, divide towards Melozitna River, 65° 20' N.—154° 30' W. Elevation between 800-4000 ft. above sea-level.	June 23 to July 5, 1926
LOWER YUKON AND DELTA			
20.	Nos. 816-833	Holy Cross Mission, 62° 13' N.—159° 45' W.	July 5, 1926
21.	Nos. 834-841	Just above delta, abt. 62° N.—163° 30' W.	July 13, 1926
22.	Nos. 842-845A	Marshall Wireless Station, 61° 55' N.—162° 05' W.	July 8, 1926
23.	Nos. 846-887	Kotlik in the delta, 63° 3' N.—163° 35' W.	July 10-14, 1926
NORTON SOUND REGION			
24.	Nos. 888-937	Volcanic hills back of Pastolik, 63° 8' N.—163° W. Elevation 1000 ft. above sea-level.	July 21, 1926
25.	Nos. 938-1026	Pastolik, low tundra at sea-level, 63° 22' N.—163° W.	July 16-20, ² 1926
26.	Nos. 1027-1030	St. Michaels, 63° 30' N.—162° W.	July 25, 1926
27.	Nos. 1031-1067	Low volcanic hills back of Qigertariaq, 63° 35' N.—161° W.	July 27, 1926
28.	Nos. 1068-1098	Qigertariaq, low meadows and sea-shore, 63° 35' N.—161° W.	July 27, 1926
29.	Nos. 1099-1120	Unalaklet, low meadows and sea-shore, 63° 52' N.—160° 45' W.	July 29-30, 1926

¹ Collection by H. M. Laing.

² Due to a misprint part of this collection was distributed erroneously dated July 16-29, 1926.

No. on map	Serial Number	Place and location	Date
LOWER YUKON AND DELTA— <i>Continued</i>			
30.	Nos. 1121-1170	Low hills 10-15 miles back of Unalaklet. Elevation 1000-2000 ft. above sea-level.	July 29, 1926
SEWARD PENINSULA			
31.	Nos. 1171-1173	Golofnin, 64° 30' N.-163° W.	August 1, 1926
32.	Nos. 1174-1299	South coast near Bluff, 64° 33' N.-163° 45' W. Elevation 0-1500 ft. above sea-level.	Aug. 5-6, 1926
33.	Nos. 1300-1408	Nome, Anvil Hill and Dexter Creek, about 64° 30' N.-165° 20' W. Elevation 0-1500 ft. above sea-level.	Aug. 6-10, 1926
34.	Nos. 1409-1452	Port Clarence, near Teller, 65° 16' N.-166° 20' W., sea-shore and low tundra.	Aug. 24, 1926
35.	Nos. 1453-1486	North coast, Kiwalik, 65° 50' N.-162° W.	Aug. 26, 1926
36.	Nos. 1487-1634	North coast, Buckland River, 26 miles above the delta, near Nunatsiaq village, 66° N.-161° 4' W.	Sept. 7-10, 1926
LITTLE DIOMEDE ISLAND			
37.	Nos. 1640-1730	Little Diomed Island, 65° 46' N.-168° 55' W.	Aug. 14-20, 1926

In the catalogue the undermentioned symbols indicate the herbarium in which the specimen cited was seen. Where no symbol is appended the specimen is in the Herbarium of the National Museum of Canada. Where no collector's name is given the collection is that of the writer and his brother.

C—Herbarium of the University of Copenhagen.

Can—Herbarium of the National Museum of Canada, Ottawa.

G—Gray Herbarium, Harvard University, Cambridge, Mass.

NY—Herbarium of the New York Botanical Garden, New York.

T—private herbarium of Mr. Charles Thornton, Nome, Alaska.

US—United States National Herbarium, Washington, D. C.

The families and the genera are arranged essentially according to Dalla Torre et Harms, *Genera Siphonogamarum* (1907). Within the genera the species, for the sake of convenience, are arranged alphabetically, except in the genus *Carex* where the arrangement followed is that of Mackenzie in *N. Am. Fl.* 18 (1935).

ANNOTATED CATALOGUE OF VASCULAR PLANTS

WOODSIA ALPINA (Bolton) S. F. Gray;¹ *W. hyperborea* R. Br. (probably not *W. alpina* of Gray's Man. Ed. 7, 44).—NORTON SOUND: volcanic hills back of Pastolik, No. 889; low hills back of Unalaklet, No. 1121. On moist cliffs.

W. GLABELLA R. Br.—ALASKA RANGE: Richardson Highw. between Summit and McCarty, No. 380. NORTON SD.: low hills back of Unalaklet, No. 1122. SEWARD PEN.: south coast near Bluff, No. 1175; Nome, moist cliffs, No. 1303; Anvil Hill, dry gravel, No. 1302. Rare or occasional in gravelly places in the mountains throughout the region.

W. ILVENSIS (L.) R. Br.—ALASKA RANGE: Broad Pass, No. 1. KOKRINES MTS.: divide towards Melozitna R. No. 685. NORTON SD.: low, volcanic hills at Qigertariaq, No. 1031.

CYSTOPTERIS FRAGILIS (L.) Bernh.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 106. ALASKA RANGE: Mts. between Healy and Moody Cr., No. 244; Nenana Valley, Lignite, No. 274; Richardson Highw. between Summit and McCarty, No. 379; Head of Chitina R., *H. M. Laing*, Nos. 1 & 2. NORTON SD.: volcanic hills back of Pastolik, No. 888; low, volcanic hills, Qigertariaq, No. 1032. SEWARD PEN.: south coast, Bluff, No. 1174; Nome, Anvil Hill, No. 1301. Common in moist, shaded places throughout the region.

C. MONTANA (Lam.) Bernh.—ALASKA RANGE: Nenana Valley, Healy, No. 317; Richardson Highw., Castner Glacier, No. 453. SEWARD PEN.: Nome, Anvil Hill, No. 1300.

DRYOPTERIS AUSTRIACA (Jacq.) Woytnar; *Dr. dilatata* (Hoffm.) A. Gray.—ALASKA RANGE: Nenana Valley, Healy, No. 318; Richardson Highw., Castner Glacier, No. 455. LOWER YUKON: Marshall, No. 842. NORTON SD.: low, volcanic hills at Qigertariaq, No. 1033. Occasional in open woods and thickets, north to Kotzebue Sd.

DR. FRAGRANS (L.) Schott.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 107. KOKRINES MTS.: divide towards Melozitna R., No. 686. NORTON SD.: hills back of Unalaklet, No. 1123. SEWARD PEN.: north coast, Buckland R., No. 1487. Probably common in alpine places throughout the region.

DR. LINNAEANA C. Chr.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 456. TANANA R.: Hot Springs, No. 631; Holy Cross, No. 816.

Previously known from S. and S. W. Alaska only.

DR. PHEGopteris (L.) C. Chr.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 454. TANANA R.: Hot Springs, No. 632. SEWARD PEN.: Nome (*Eastwood*).

New to Central Alaska.

¹ The Alaska material of Polypodiaceae was kindly checked by Dr. Carl Christensen, Copenhagen.

DR. ROBERTIANA (Hoffm.) C. Chr.—Not seen by us, but collected on YUKON R.: between Tanana and Ramparts, *L. J. Palmer*, No. 39 (Can).

Also known from Dawson, Yukon Ter., *M. O. Malte*, No. 72 (Can.).

BOTRYCHIUM LUNARIA (L.) Swartz.—ALASKA RANGE: Nenana Valley, Healy, No. 319; Richardson Highw., between Summit and McCarty, No. 381. KOKRINES MTS.: divide towards Melozitna R., No. 688. SEWARD PEN.: Nome, Anvil Hill, No. 1303-A.

Previously recorded from S. and S. W. Alaska only.

B. LUNARIA (L.) Swartz var. MINGANENSE (Vict.) Dole in Fl. of Vermont, ed. 3: 1 (1937). *B. minganense* Vict. in Contr. Lab. Bot. Univ. Montreal, 11: 331 (1927).—KOKRINES MTS.: divide towards Melozitna R., No. 687.

In the large series are many intermediate forms between the variety and the head species. New to the flora of Alaska.

EQUISETUM ARVENSE L.—ALASKA RANGE: Nenana Valley, Lignite, No. 275. HEAD OF CHITINA R.: *H. M. Laing*, No. 3. SEWARD PEN.: south coast, Bluff, No. 1176-A; Nome, *Thornton*, No. 90 (T); north coast, Buckland R., No. 1488. Common throughout the region.

E. LIMOSUM L.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 113; muskeg east of town, No. 158. ALASKA RANGE: Richardson Highw., Summit (field notes). NORTON SD.: low hills back of Unalaklet, No. 1124. SEWARD PEN.: north coast, Buckland R., No. 1489.

Previously recorded from S. and S. W. Alaska only.

E. PALUSTRE L.—FAIRBANKS: muskeg east of town, No. 156-A. YUKON R.: Kokrines, No. 614. SEWARD PEN.: south coast, Bluff, No. 1177.

Previously recorded only from S. E. Alaska.

E. PRATENSE Ehrh.—HEAD OF CHITINA R.: above timber line, 4000 feet elevation, *H. M. Laing*, No. 4. YUKON RIVER: Birches, No. 604. SEWARD PEN.: Nome, *Thornton*, No. 357 (T).

Previously known only from Seward Pen. (*Eastwood*).

E. SCIRPOIDES Michx.—ALASKA RANGE: Broad Pass, No. 5. FAIRBANKS: in a muskeg, No. 157; College, No. 212. ALASKA RANGE: Nenana Valley, Lignite, No. 276; Healy, No. 320. HEAD OF CHITINA R.: *H. M. Laing*, Nos. 5 and 6. NORTON SD.: Pastolik, No. 938. SEWARD PEN.: south coast, Bluff, No. 1176; Port Clarence, No. 1409. Common throughout the region, north to Kotzebue Sd.

E. SYLVATICUM L. var. SQUARROSUM A. A. Eat. in Fern Bull. 9: 36 (1901).—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 112. SEWARD PEN.: *Thornton* (no number) (T).

Fernald in RHODORA, 20: 129 (1918), has pointed out that the var.

squarrosus, characterized by rough branches, is the plant of Eurasia, whereas all material from North America, excepting some specimens from Alaska and Yukon, belong to var. *pauciramosus* Milde. The type of var. *squarrosus* came from SEWARD PEN.: Nome, *Flett*, No. 1524 (G).

E. VARIEGATUM Schleich.—FAIRBANKS: in a muskeg, No. 156. HEAD OF CHITINA R.: *H. M. Laing*, No. 7. KOKRINES MTS.: divide towards Melozitna R., No. 689; near hot sulphur springs, No. 658. SEWARD PEN.: south coast, Bluff, No. 1177-A. Common throughout the region.

LYCOPodium ALPINUM L.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 109-A. ALASKA RANGE: Richardson Highw., Castner Glacier, No. 458. NORTON SD.: hills back of Unalaklet, No. 1127. SEWARD PEN.: Nome, Anvil Hill, No. 1306; north coast, Buckland R., No. 1490. Rare or occasional in alpine places throughout the region.

L. ANNOTINUM L.—ALASKA RANGE: Nenana Valley, Healy, No. 321. KOKRINES MTS.: divide towards Melozitna R., No. 691. SEWARD PEN.: Nome, *Thornton*, No. 364 (T); north coast, Buckland R., No. 1492. Probably common throughout the region.

All the material except the first number belongs to var. PUNGENS (La Pylaie) Desv.

L. CLAVATUM L. var. MONOSTACHYON Grev. & Hook.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 110; College, No. 213. ALASKA RANGE: Broad Pass, No. 2. KOKRINES MTS.: divide towards Melozitna R., No. 694. NORTON SD.: hills back of Unalaklet, No. 1125. Occasional in open, dry spruce woods.

L. COMPLANATUM L.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 109; College, No. 214. ALASKA RANGE: Broad Pass, No. 4. KOKRINES MTS.: divide towards Melozitna R., No. 692. NORTON SD.: hills back of Unalaklet, No. 1126.

The above material has been referred by Victorin (in herb.) to var. CANADENSIS Vict. in Contr. Lab. Bot. Univ. Montr. No. 3: 70 (1925).

L. OBSCURUM L. var. DENDROIDEUM (Michx.) D. C. Eaton (see Fernald in RHODORA 19: 188 (1921))—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 108. KOKRINES MTS.: divide towards Melozitna R., No. 693.

Not previously recorded from the mainland of Alaska north of Sitka; known also from Attu, westernmost island of the Aleutian chain (Hultén, Fl. Aleut. Isl. 60 (1937)).

L. SELAGO L.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 111. ALASKA RANGE: Broad Pass, No. 3; Richardson Highw., Castner Glacier, No. 459. NORTON SD.: Pastolik, No. 939; hills back of Unalaklet, No. 1128. SEWARD PEN.: north coast, Buckland R., No.

1491. DIOMEDE ISL.: No. 1640. Rare or occasional in mountains of the interior, common in the Bering Sea region.

SELAGINELLA SELAGINOIDES (L.) Link.—ALASKA RANGE: Nenana Valley, Lignite, No. 277. SEWARD PEN.: Nome, No. 1304.

From Alaska not previously recorded from north of the Aleutian chain or Kenai Pen. (Hultén, Fl. Aleut. 62 (1937).)

S. SIBIRICA (Milde) Hieron. in Hedwigia **39**: 290 (1900). *S. Schmidtii* Trelease in Harriman Alaska Exp. **5**: 394. (1905).—RICHARDSON HIGHW.: near Munson, No. 159. ALASKA RANGE: Nenana Valley, Healy, No. 322. KOKRINES MTS.: divide towards Melozitna R., No. 690. SEWARD PEN.: Nome, Anvil Hill, No. 1305.

According to Hultén, Fl. Aleut. 62 (1937), the proper name for the plant of Alaska, which has generally passed as *S. rupestris* Rupr., is *S. sibirica*. Our material is a good match also of *S. Standleyi* Maxon in Smithson. Misc. Publ. **5**: 72 (1920). Rare or occasional in dry, gravelly places.

[PINUS PUMILA Regel.—The puzzling record in literature of "*Pinus Cembra*" from Kotzebue Sd. is due to Ledebour, who (Fl. Ross. **3**: 674) in error cites Hooker & Arnott (Beechey's Voy.) as having recorded the pine from Kotzebue Sd. As a matter of fact these authors mention no conifers from that place and record *Pinus Cembra* only from Kamtchatka. The error is perpetuated by later authors, e. g. Rothrock, Turner, and last by Gelert in Ostenfeld, Fl. Arctica **1**: 15 (1902). *Pinus pumila* may safely be excluded from the flora of Alaska.]

LARIX LARICINA (DuRoi) Koch. *L. alaskensis* Wight in Smiths. Misc. Coll. **1**: 174, tab. 17 (1907), fide Ostenfeld & Larsen, Kgl. Dansk Vidensk. Selsk. Biol. Medd. **9**, 2: 86 (1930).

The larch, in field notes, was recorded as common in the Alaska Range and in the Fairbanks region. According to Ostenfeld & Larsen l. c. (map viii), distributed throughout the interior of Alaska, from the upper Yukon R. to the lower Kuskokwim R.

PICEA GLAUCA VOSS. *P. canadensis* sensu B. S. P., not Link.—HEAD OF CHITINA R.: H. M. Laing, No. 8. KOTZEBUE SD.: Napaktolik R., No. 6199.

The white spruce, in field notes, was recorded as common in all parts of the interior visited by the author. In the Alaska Range the tree limit was generally found between 2000 and 3000 feet. On the lower Yukon the white spruce is absent below Marshall. In the Norton Sd. region it reappears some distance back from the coast but at Elim, on the north shore of Norton Bay, fair sized spruce reach the coast. In Seward Peninsula, Buckland River is well timbered fifty miles above its delta. Splendid stands of white spruce were also seen

on Koyuk R., and on some of its eastern tributaries. Some trees on Quartz Cr. near the divide measured 75 feet in height and produced fine building logs 24 feet long. All the larger rivers discharging into Kotzebue Sd. are timbered, the Noataq north at least to 68° N.

P. MARIANA (Mill.) B. S. P.

The black spruce, in field notes, was recorded as common in the Alaska Range and on the upper Yukon. No black spruce was seen on Norton Sd., Seward Peninsula, or on the rivers draining into Kotzebue Sd.

JUNIPERUS COMMUNIS L.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 515; between Paxon and Summit, No. 516. HEAD OF CHITINA R.: *H. M. Laing*, No. 9. The material all belongs to the var. MONTANA Ait.

New to the flora of central Alaska.

J. HORIZONTALIS Moench.—HEAD OF CHITINA R.: elevation 2000 to 2500 feet, *H. M. Laing*, Nos. 10 and 11.

This species does not appear to have been recorded previously from Alaska.

SPARGANIUM HYPERBOREUM Laest.—ALASKA RANGE: Broad Pass, No. 8 (last year's fruiting plant). KOKRINES MTS.: divide towards Melozitna R., No. 695. YUKON DELTA: Kotlik, No. 848. NORTON SD.: Unalaklet, No. 1100; hills back of Unalaklet, No. 1129. SEWARD PEN.: Nome, Nos. 1307 and 1308; *Thornton*, No. 449 (T); north coast, Kiwalik R., No. 1454; Buckland R., Nos. 1493 and 1495. Probably common in the lowland throughout the region.

S. MINIMUM Fries.—FAIRBANKS: No. 593. ALASKA RANGE: Broad Pass, *L. J. Palmer*, No. 1877 (US). YUKON R.: Holy Cross, No. 820.

S. MULTIPEDUNCULATUM (Morong) Rydb. *S. simplex* Am. authors, not Huds. See Fernald in RHODORA 27: 190 (1925) and 33: 24 (1931). —YUKON RIVER: Holy Cross, Nos. 818 and 819. YUKON DELTA: Kotlik, No. 849. NORTON SD.: Pastolik, Nos. 944 and 945. SEWARD PEN.: north coast, Buckland R., No. 1494.

New to the flora of Alaska.

POTAMOGETON FILIFORMIS Pers.¹—NORTON SD.: Pastolik, No. 940; Unalaklet, No. 1101. SEWARD PEN.: Port Clarence, No. 1410-A. Common in lakes of the Bering Sea region, north to Kotzebue Sd.

P. FILIFORMIS Pers. var. BOREALIS (Raf.) St. John.—ALASKA RANGE: Nenana Valley, Lignite, No. 278. NORTON SD.: Pastolik, No. 941; Unalaklet, No. 1099.

¹ Professor M. L. Fernald kindly examined and identified *Potamogeton* in the collection. Our material of *P. Porsildiorum* and *P. pusillus* is included in the distribution given for those species in his monograph of the linear-leaved species of *Potamogeton* in Mem. Am. Acad. 17, 1 (1932).

P. GRAMINEUS L. var. *GRAMINIFOLIUS* Fries. *P. heterophyllus* of most Am. auth.—FAIRBANKS: *L. J. Palmer*, No. 1866 (U.S.). NORTON SD.: Unalaklet, No. 1131. SEWARD PEN.: north coast, Buckland R., No. 1497. SELAVIK L.: *L. J. Palmer*, 1923 (U.S.).

P. PERFOLIATUS L. var. *GRACILIS* Fries.—FAIRBANKS: *L. J. Palmer*, No. 1862. YUKON R.: Holy Cross, No. 817. SEWARD PEN.: north coast, Buckland R., No. 1499. Perhaps the most common member of the genus within the parts of Alaska visited.

P. PORSILDIORUM Fernald in Mem. Am. Acad. 17, 1: 40; Pl. 2, figs. d & e; Pl. 28, fig. 4; Pl. 32, fig. 2 and Pl. 39, fig. 5; map 3 (1932).—FAIRBANKS: Goldstream Cr. and Pedro Dome, June 12, 1926 (no number). SEWARD PEN.: north coast, Buckland R., No. 1498.

This rare plant, the type of which came from the Mackenzie Delta, N.W.T., is known in addition from one station in the Hudson Bay region. According to Fernald l. c. *P. Porsildiorum* is closely related to the Siberian *P. subsibiricus* Hagstr.

P. PUSILLUS L.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 116. The var. *TENUISSIMUS* M. & K. was found in the same place, No. 115.

P. RICHARDSONII (Benn.) Rydb.—RAT R. ON THE PORCUPINE R.: above Ft. Yukon, *R. Kennicott* (NY). YUKON DELTA: Kotlik, No. 847. NORTON SD.: Pastolik, No. 943; Unalaklet, No. 1102.

P. TENUIFOLIUS Raf. *P. microstachys* Wolfg. See Fernald in RHODORA 33: 209 (1931).—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 114. RAT R. ON THE PORCUPINE R.: above Ft. Yukon, *R. Kennicott* (U.S.). NORTON SD.: Pastolik, No. 942; Unalaklet, No. 1130. SEWARD PEN.: north coast, Buckland R., No. 1496.

P. VAGINATUS Turcz. *P. moniliformis* St. John.—YUKON DELTA: Kotlik, No. 846.

This species does not appear to have been recorded previously from Alaska, although one sheet from the ALEUTIAN ISL.: Atka, Eyerdam, No. 1290 (Can.), distributed as *P. filiformis* Pers. var. *borealis* (Raf.) St. John, seems to belong here.

ZANNICHELLIA PALUSTRIS L. See Porsild in RHODORA 34: 94 (1932).—SEWARD PEN.: north coast, Buckland R., No. 1499.

ZOSTERA MARINA L.—NORTON SD.: Golofnin Bay, No. 1171. SEWARD PENINSULA: Port Clarence, No. 1410. See Porsild, RHODORA 34: 90 (1932).

RUPIA SPIRALIS L.

There is in the National Herbarium of Canada a sheet marked "Alaska, Pt. Etcher, Lat. 60°, June 18, 1892, *J. M. Macoun*, No. 28-133." The writer has not been able to find that locality on any of the Alaska maps he has examined. Hultén, Fl. Aleut. 67 (1937), for the

first time records the species from Alaska, Amlia Is. and the Pribilof Islands. Macoun's unpublished record thus extends the range of *Ruppia* still farther north.

TRIGLOCHIN PALUSTRIS L.—FAIRBANKS: in a muskeg, No. 183, *L. J. Palmer*, No. 1779 (US). ALASKA RANGE: Nenana Valley, Lignite, Healy and Moody Cr., No. 289; Richardson Highw., between Summit and McCarty, No. 410. NORTON SD.: Qigertariaq, No. 1077; St. Michaels, *W. E. Nelson*, (US). SEWARD PEN.: Nome, Dexter Cr., No. 1306; south coast, Bluff, No. 1205.

Previously recorded from S. E. Alaska only.

HIEROCHLOË ALPINA (Sw.) Roem. & Schult.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 118. ALASKA RANGE: Broad Pass, No. 9; Richardson Highw., Castner Glacier, No. 466. NORTON SD.: hills back of Pastolik, Nos. 890 and 891 (the last is a viviparous form); Pastolik, No. 958; Qigertariaq, No. 1037. SEWARD PEN.: Port Clarence, No. 1412; north coast, Buckland R., No. 1510. DIOMEDE ISL.: No. 1645 (luxuriant form). Common throughout the region.

H. ODORATA (L.) Wahlenb.—ALASKA RANGE: Richardson Highw., between Paxon and Summit, No. 517.

H. PAUCIFLORA R. Br.—YUKON DELTA: Kotlik, No. 850. SEWARD PEN.: north coast, Buckland R., No. 1511. DIOMEDE ISL.: No. 1646. Common in Sphagnum bogs in low tundra of the Bering Sea region.

PHLEUM ALPINUM L.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 465.

There does not appear to be any previous record of this plant from the interior of Alaska.

PH. PRATENSE L.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 383 (becoming established). YUKON R.: Kokrines, No. 616 (naturalized on riverbanks).

ALOPECURUS AEQUALIS Sobol. var. *NATANS* (Wahlenb.) Fernald in *RHODORA* 27: 196 (1925).—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 384. YUKON R.: Holy Cross, No. 821.

The var. *natans* seems well distinguished from the typical form of the species by the almost total absence of an awn. Previously known from S. E. Alaska only.

A. ALPINUS Sm. *A. Stejnegeri* Vasey in Proc. U. S. Nat. Mus. 10: 153 (1887); *A. beringianus* Gdgr. in Bull. Soc. Bot. France, 66: 298 (1920); *A. alpinus* Sm. var. *Stejnegeri* (Vasey) Hultén, Fl. Aleut. 70 (1937).—YUKON DELTA: Kotlik, No. 851. NORTON SD.: Pastolik, Nos. 946, 947 and 948.

The above numbers, all except No. 947, belong to the curious looking form (f. *Stejnegeri*, n. comb.) originally described from the

Commander Islands. Forma *Stejnegeri*, notwithstanding its rather striking appearance, is considered merely an edaphic form caused by excess nitrogen and a moist climate. It is known chiefly from bird- and seal-rookeries of the Bering Sea region but wherever found typical plants as well as intermediate forms are common.

A. OCCIDENTALIS Scribn. & Tweedy in Bot. Gaz. 11: 170 (1886).—NORTON SD.: hills back of Unalaklet, No. 1136. SEWARD PEN.: Nome, *A. S. Hitchcock*, No. 333 (G) as *A. alpinus*.

According to Hultén, Fl. Kamtch. 1: 92 (1927), *A. occidentalis* may prove the same as *A. glaucus* Less. Although by some writers reduced to synonymy (Hitchcock, Man. 787 (1935)), *A. occidentalis* differs strikingly from *A. alpinus* by its long, slender, creeping rhizomes and by its tall, slender and conspicuously glaucous culms that are leafy to the top. In our specimens the culms are 60 to 70 cm. tall and the leaves very scabrous; the flowering spikes are 16 mm. long and the awns shorter than those shown by Hultén, l. c. fig. 8. *A. occidentalis*, in America, was previously known only from Alberta, Utah and Colorado.

The following five sheets in the Nat. Herb. of Canada, all under *A. alpinus*, belong here. ALBERTA: Elbow R., *Macoun*, No. 18,626; Milk R., *Macoun*, No. 13,010; Old Man R., *Dawson*, No. 30,178; Crow's Nest Forest Reserve, *Cram*, No. 102,788. YUKON TERRITORY: Ranch Cr., *Gorman*, No. 1004.

PHIPPSIA ALGIDA (Soland.) R. Br.—NORTON SD.: Pastolik, No. 949. DIOMEDE ISL.: Nos. 1642 and 1643 (the last is a luxuriant form).

Previously known from Kotzebue Sd. and the north coast.

ARCTAGROSTIS ARUNDINACEA (Trin.) Beal, Grasses of N. Am. 2: 317 (1896). *A. macrophylla* Nash in Bull. N. Y. Bot. Gard. 2: 151, (1901).—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 460. KOKRINES MTS.: divide towards Melozitna R., No. 700. YUKON DELTA: Kotlik, No. 855. NORTON SD.: Pastolik, No. 951. SEWARD PEN.: south coast, Bluff, No. 1182; Nome, *Thornton*, 87 (T); Port Clarence, No. 1415; north coast, Buckland R., No. 1513.

The writer has seen a sheet in U. S. Nat. Herb. said to be part of the TYPE in Trinius' herbarium, with a copy of the original label, reading: "*Vilfa arundinacea* m [ihi]. Archipelago Kotzebue—*Fischer*." The 5 or 6 branchlets on the sheet well match Trinius' Spec. Gram. Icon. & Desc. 1, icon. 55 (1828). The type of *A. macrophylla* Nash came from Dawson, Yukon Territory, *R. S. Williams*, July 14, 1899 (NY). It differs in no way from *A. arundinacea*. Common throughout the region, especially on alluvial soil.

A. LATIFOLIA (R.Br.) Griseb.—ALASKA RANGE: Broad Pass (field notes). SEWARD PEN.: Nome, No. 1312. DIOMEDE ISL.: No. 1650. Common on the Bering Sea coast to north of Seward Pen., and in alpine meadows of the interior.

AGROSTIS BOREALIS Hartm.—NORTON SD.: hills back of Qigertariaq, No. 1035. SEWARD PEN.: north coast, Buckland R., No. 1512. The material belongs to var. *TYPICA* Fern. in RHODORA, **35**: 203–207 (1933).

A. SCABRA Willd. *A. hyemalis* of many authors, not (Walt.) B. S. P. See Fernald in RHODORA, **35**: 207–212 (1933).—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 393. TANANA R.: Hot Springs, No. 635. KOKRINES MTS.: divide towards Melozitna R., No. 705.

CALAMAGROSTIS CANADENSIS (Michx.) Nutt. var. *LANGSDORFFII* (Link) Inman.—KOKRINES MTS.: divide towards Melozitna R., No. 698. NORTON SD.: hills back of Pastolik, No. 894; Pastolik, No. 955. SEWARD PEN.: north coast, Kiwalik, No. 1457; Buckland R., Nos. 1501, 1504, 1505, 1507 and 1508. Common throughout the region and perhaps the most common grass of the interior.

C. DESCHAMPSIOIDES Trin.—DIOMEDE ISL.: Nos. 1649, 1651, 1652 and 1658. See Porsild in Trans. Roy. Soc. of Can. Ser. 3, Sect 5, **32**: 27 (1938).

C. NEGLECTA (Ehrh.) Gaertn.—YUKON R.: Kokrines, No. 615. NORTON SD.: Pastolik, No. 895. SEWARD PEN.: north coast, Kiwalik, No. 1455; Buckland R., No. 1506. Common in low tundra in the Bering Sea region.

C. NUTKAENSIS (Presl) Steud. *C. aleutica* Trin.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 396.

Not previously recorded from north of the Pacific coast and the Aleutian chain.

C. PURPURASCENS R.Br.—FAIRBANKS: College, No. 216. ALASKA RANGE: Nenana Valley, Lignite, No. 279; Healy, No. 323; Richardson Highw., between Summit and McCarty, Nos. 395, 397 and 398. HEAD OF CHITINA R.: *H. M. Laing*, No. 12. Known also from Seward Pen. (Scribn. & Merr.).

DESCHAMPSIA CESPITOSA (L.) Beauv.—ALASKA RANGE: Mts. between Healy and Moody Cr. No. 245; Richardson Highw., between Summit and McCarty, No. 390. KOKRINES MTS.: divide towards Melozitna R., No. 697. SEWARD PEN.: south coast, Bluff, No. 1183; Nome, No. 1313. Common throughout the region.

TRisetum SIBIRICUM Rupr. *T. flavescens* of authors, not (L.) Beauv.—NORTON SD.: hills back of Pastolik, No. 893; Pastolik, No. 956. SEWARD PEN.: Port Clarence, No. 1414. In northwest Alaska previously known from the last mentioned place only.

T. SPICATUM (L.) Richt. var. *MAIDENII* (Gand.) Fern.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 382. KOKRINES MTS.: divide towards Melozitna R., No. 706. NORTON SD.:

hills back of Pastolik, No. 892; Pastolik, No. 957. SEWARD PEN.: north coast Buckland R., No. 1509. DIOMEDE ISL.: No. 1648 (the last perhaps is var. *molle*). Common throughout the region.

BECKMANNIA SYZIGACHNE (Steud.) Fern. in RHODORA, 30: 24 (1928).—YUKON R.: Kokrines, No. 618. Previously known from Fort Yukon (Scribn. & Merr.).

DUPONTIA PSILOSANTHA Rupr. *D. Fisheri* auth., non R. Br. saltem quoad pl. A1.—YUKON DELTA: Kotlik, Nos. 853 and 854. NORTON SD.: Qigertariaq, No. 1034. SEWARD PEN.: south coast, bluff, No. 1190; Port Clarence, No. 1411 (a viviparous form). Common in wet, brackish meadows throughout the Bering Sea region.

POA ALPIGENA (Fries) Lindm.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 462-A. SEWARD PEN.: Nome, No. 1310. Both are proliferous forms. Probably common throughout the region.

P. ALPINA L.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 391; Castner Glacier, No. 461; Paxon, No. 572. SEWARD PEN.: Nome (*Eastwood*). Rare or occasional in mountains of the interior.

P. ARCTICA R. Br. *P. rigens* Hartm.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 463; YUKON DELTA: Kotlik, No. 852. NORTON SD.: Pastolik, No. 953; Unalaklet, No. 1133. SEWARD PEN.: Port Clarence, No. 1413; north coast, Buckland R., Nos. 1520 and 1521. DIOMEDE ISL.: Nos. 1653 to 1656. Common in dry tundra throughout the region.

P. EMINENS Presl. *P. Trinii* Scribn. & Merr.—NORTON SD.: Qigertariaq, No. 1070; St. Michaels, No. 1027. SEWARD PEN.: Nome, *Thornton* (no number) (T). Common on sea-shores of the Bering Sea region, north to Seward Pen.

P. GASPENSIS Fernald in RHODORA, 31: 46 (1929).—KOKRINES MTS.: divide towards Melozitna R., dry ridges 1500 to 2000 feet above sea level, No. 703.

Our specimens were tentatively so named by Mrs. Agnes Chase, U. S. Nat. Herb., although this species so far has been found on the Gaspé Peninsula, Que. only. Superficially the material resembles the polymorphic *P. glauca*, but, as pointed out by Mrs. Chase (in litt.), the lemmas are webbed close to the keel.

P. GLAUCA M. Vahl.—FAIRBANKS: College, No. 215. ALASKA RANGE: Nenana Valley, Healy, No. 324; Richardson Highw., between Summit and McCarty, No. 392; Castner Glacier, No. 462. KOKRINES MTS.: divide towards Melozitna R., Nos. 701 and 702. NORTON SD.: Qigertariaq, No. 1036. SEWARD PEN.: south coast, Bluff, No. 1186. Common in dry, barren places throughout the region.

P. LEPTOCOMA Trin.¹—KOKRINES MTS.: divide towards Melozitna R., No. 704. DIOMEDE ISL.: No. 1657.

¹ *Poa leptocoma*, *P. gaspensis* and *P. Wrightii* (No. 1314 only) were named by Mrs. Agnes Chase, U. S. National Herbarium.

P. WRIGHTII (Scribn. & Merr.) Hitchc. in Am. Journ. of Bot. **2**: 309 (1915). *Colpodium Wrightii* Scribn. & Merr. in Contr. U. S. Nat. Herb. **13**, 3: 74 (1910).—SEWARD PEN.: Nome, No. 1314; north coast, Buckland R., No. 1522.

The type came from E. Asia (Arakamtchatchene Isl., *Wright*, U. S. No. 592344). According to Scribner & Merrill, l. c., the species was known previously from SEWARD PEN.: Port Clarence (*Walpole*).

GLYCERIA GRANDIS Wats.—YUKON R.: Holy Cross, No. 822.

Previously known from S. E. Alaska.

G. STRIATA (Lam.) Hitchc. var. *STRICTA* (Scribn.) Fern. in RHODORA, **31**: 47 (1929). *G. verrata* (Willd.) Trin. var. *stricta* Scribn.—TANANA R.: Hot Springs, No. 633.

Not previously recorded from Alaska.

PUCCINELLIA ARCTICA (Hook.) Fern. & Weath.—NORTON SD.: Qigertariaq, No. 1068. SEWARD PEN.: south coast, Bluff, Nos. 1184 and 1185. Common on sea-shores of the Bering Sea region.

P. DISTANS (L.) Parl.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 389. Introduced, but becoming established along the road.

P. PAUPERCULA (Holm) Fern. & Weatherby var. *ALASKANA* (Scribn. & Merr.) Fern. & Weatherby.—DIOMEDE ISL.: Nos. 1641 and 1644. SEWARD PEN.: Cape Prince of Wales (field notes). Probably common on sea-shores throughout the Bering Sea region.

P. PHRYGANODES (Trin.) Scribn. & Merr.—NORTON SD.: Qigertariaq; common in salt marshes bordering lagoon, No. 1069.

ARCTOPHILA FULVA (Trin.) Rupr. *Colpodium fulvum* (Trin.) Griseb.—YUKON R.: Holy Cross (field notes). YUKON DELTA: Kotlik, No. 856. NORTON SD.: Pastolik, No. 952; Unalaklet, No. 1135. SEWARD PEN.: Kiwalik, No. 1456; Buckland R., Nos. 1517 to 1519, the last two rare viviparous forms. DIOMEDE ISL.: No. 1647. Common in wet meadows on the lower Yukon and in the Bering Sea region.

FESTUCA ALTAICA Trin.—FAIRBANKS: Goldstream Cr. and Pedro Dome, No. 117. ALASKA RANGE: Richardson Highw., Paxon, No. 518. NORTON SD.: Unalaklet, No. 1134. Occasional in dry open woods and thickets, north to Seward Pen.

F. BRACHYPHYLLA Schultes. *F. brevifolia* R. Br.—ALASKA RANGE: Richardson Highw., Castner Glacier, No. 464. KOKRINES MTS.: divide towards Melozitna River, No. 699. NORTON SD.: hills back of Pastolik, No. 896; hills back of Unalaklet, No. 1132. Common in dry, barren places throughout the region.

F. RUBRA L. var. *ARENARIA* (Osbeck) Fries.—ALASKA RANGE: Nenana Valley, Lignite, No. 280. NORTON SD.: Pastolik, No. 950; Unalaklet, Nos. 1103 and 1104. SEWARD PEN.: south coast, Bluff, Nos. 1180 and 1181; Port Clarence, No. 1411-A; north coast, Buckland R., Nos. 1515 and 1516.

Festuca rubra in Alaska is most variable in regard to shape of panicle, number of flowers in the spikelets and the degree of pubescence of the floral bracts. Differing from all the above by their low culms, open panicles and entirely glabrous lemmas, short awns and long anthers, are the following: SEWARD PEN.: south coast, Bluff, Nos. 1178 and 1179.

F. VIVIPARA (L.) Sm.—SEWARD PEN.: Nome, No. 1311.

Apparently not previously recorded from Alaska.

BROMUS CILIATUS L. *B. Richardsoni* Link. See Hultén, Fl. Kamtch. 1: 148 (1927).—TANANA R.: Hot Springs, alluvial banks, No. 634.

B. PACIFICUS Shear in U. S. Dept. Agr. Div. Agrost. Bull. 23: 38, fig. 21 (1900).—SEWARD PEN.: south coast, Bluff, No. 1187; north coast, Buckland R., No. 1514.

Our specimens have lax, open and more or less nodding panicles; the glumes and lemmas are pubescent.

B. PUMPELLIANUS Scribn.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 387. Previously known from the upper Yukon and Fairbanks region.

B. PUMPELLIANUS Scribn. var. **arcticus** (Shear), n. comb. *B. arcticus* Shear in Scribn. & Merr. in Contr. U. S. Nat. Herb. 13, 3: 83 (1910); *B. ciliatus* sensu Rothr., Sketch Fl. Al. 458 (1867), non L.; *Schedonorus ciliatus* (L.) Kjellm., Vega Exp. 1: 557 (1882); Ostf., Fl. Arct. 1: 132 (1902); as to plant, not as to name-bringing synonym.—ALASKA RANGE: Nenana Valley, Healy, No. 326. SEWARD PEN.: Port Clarence, *Walpole*, No. 2066 (US).

The writer, having studied *B. arcticus* in the field for a number of years, has come to the conclusion that there does not seem to be sufficient reason for maintaining it as a separate species. It seems more logical to regard it as an arctic-alpine variety of the more widely distributed *B. Pumpellianus*. *B. arcticus* fairly well matches the description of *B. Pumpellianus* Scribn. var. *Tweedyi* Scribn. in Beal, Grasses of N. Am. 2: 622 (1896); but the type, Yellowstone Pk.: Fr. *Tweedy*, No. 587 (US), is a very different plant, having a pale green panicle and lemmas covered with lustrous, whitish pubescence, whereas the glumes are almost glabrous and the sheaths sparingly hirsute. The arctic plant has very hirsute sheaths, and leaves that are mostly hirsute on both sides. The nodes are covered by densely matted white hair. The glumes are always hirsute and the lemmas strongly so. The awns are somewhat shorter and the lemmas more blunt than in the species. Observations in the field have shown that

the degree of pubescence varies somewhat with the age of the plant (see also Hultén, *Fl. Kämtch.* 1: 147 (1927)). Occasional in sandy places in the Bering Sea region north to Kotzebue Sd., also in high mountains of the interior through Yukon to N. W. Mackenzie.

B. RACEMOSUS L.—YUKON R.: Kokrines, No. 617 (probably introduced).

AGROPYRON LATIGLUME (Scribn. & Sm.) Rydb. *A. violaceum* (Hornem.) Lange var. *latiglume* Scribn. & Sm.—SEWARD PEN.: south coast, Bluff, No. 1189.

A. SMITHII Rydb.—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 388 (probably introduced).

A. TRACHYCAULUM (Link) Malte, Ann. Rep. Nat. Mus. of Can. 42 (1932). *A. violaceum* (Hornem.) Lange var. *virescens* Lange, Consp. Fl. Groenl. 155 (1880).—ALASKA RANGE: Richardson Highw., between Summit and McCarty, No. 385. SEWARD PEN.: north coast, Buckland R., No. 1523.

HORDEUM JUBATUM L.—A common weed throughout the interior, north at least to the limit of horticulture.

ELYMUS ARENARIUS L. ssp. *MOLLIS* (Trin.) Hultén.—NORTON SD.: Qiqertariaq, No. 1071. SEWARD PEN.: south coast, Bluff, No. 1188; north coast, Buckland R., No. 1524. (The last number is f. *COMPOSITUS* Abromeit in *Bibl. Bot.* 8, 42: 96 (1899), described from Greenland but, according to Hitchcock, *Man. of Grasses*, 249 (1935), also found on the coast of Washington.) *DIOMEDE ISL.*: No. 1659. Common on sandy beaches throughout the Bering Sea region.

E. INNOVATUS Beal.—ALASKA RANGE: Broad Pass, No. 10; Nenana Valley, Healy, No. 325; Richardson Highw., between Summit and McCarty, No. 386. Sandy places in mountains of the interior of Alaska and Yukon Territory, east to the Mackenzie.

The report, in Scribner & Merrill in *Contr. U. S. Nat. Herb.* 13, 3: 89 (1910), from Cape Smythe (near Pt. Barrow), based upon a specimen collected by Schrader, 1901, is probably due to a confusion of labels. Schrader, in 1901, crossed the Endicott Mts. of northern Alaska by way of John R., the Anaktuvuk and Colville Rivers.¹ Two years before Schrader collected this species on Chandlar R., also in the Endicott Range; and the "Cape Smythe" plant may well have been gathered on the John River.

(To be continued)

¹ F. C. Schrader, U. S. Geol. Surv. Professional Papers 20 (1904).

POLLINATION OF VERBENA HASTATA

HARVEY B. LOVELL AND JOHN H. LOVELL

VERBENA HASTATA L., the purple vervain, is widely distributed from Nova Scotia to British Columbia, southward to Florida and New Mexico. The plant flourishes in damp fields and pastures, and, twice in twenty-four years in Iowa, during years of excessive moisture, it has bloomed in great profusion in low fertile lands and yielded a surplus of mild white honey. Robertson¹ has reported a list of insect visitors for Carlinville, Illinois, but a description of the ecology of this important species has never been published.

The slender whorls of flowers begin to bloom at the base of the spike, the flowering gradually continuing upward to its apex. An average of 6 to 7 flowers bloom at one time but, although each whorl blooms only for a few days, the period of anthesis extends over two months. So close together are the clusters of spikes that honey-bees were observed to cross from one to another without flying. This close grouping also greatly increases the conspicuousness of the inflorescence.

The homogamous flowers are sessile, salver-formed and slightly two-lipped, the two upper corolla-lobes being smaller and nearer together than the three lower. The tubular calyx is five-toothed with the two outer teeth prolonged and bent inward to afford support to the flower when it is visited by large insects. The corolla-tube is 3-4 mm. in length, curving obliquely outward, affording more room for the expanding buds and the most convenient position for the bees while sucking. The limb of the corolla, which often stands nearly vertical, is 5 mm. broad with the entrance to the tube closed by a grating of purplish hairs, except for a small opening in the center through which the proboscis of the bee passes. This ring of hairs is useful in excluding both the rain and very small insects.

The stamens are didynamous; the upper pair of anthers lie close to the entrance to the corolla-tube, while the second pair are on the opposite side of the tube a little lower down. The yellow pollen, which is glutinous, adheres to the anthers after they have dehisced. The style is short, about half the length of the corolla-tube, and two-lobed; the outer lobe is stigmatic, large and bulbous, almost completely filling half of the tube. The inner lobe is much reduced in size

¹ Robertson, Charles, *Flowers and Insects*, Page 216.

and has become smooth and pointed and no longer functions as a stigma. If both lobes were large, the passage of the bee's tongue would be obstructed. The tube between the anthers and the stigma is largely filled with white hairs, which, however, are not dense enough to prevent the passing through it of the proboscis of a large bee. But they would prevent small insects from creeping down to the nectar. In the absence of insects, self-pollination does not occur. We covered three clusters of buds with cheese cloth, before any of them had expanded, and no seed was developed. Nectar is secreted by the base

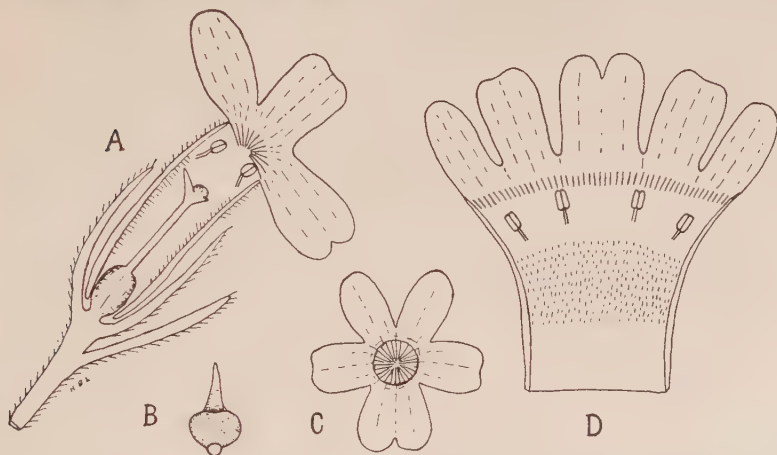


FIG. 1. *VERBENA HASTATA* L. A, Longitudinal Section of Flower, $\times 6$; B, Stigma as seen from above, $\times 28$; C, Flower from above, showing Grating of Hairs guarding Throat, $\times 4$; D, Inside View of Corolla divided lengthwise with Margins reflexed, $\times 6$.

of the corolla-tube, as was observed by Knuth¹ in the case of *V. officinalis* L.

When a bee, as a honey-bee, which can easily reach the nectar, for the first time inserts its tongue into a flower of the purple vervain, so little pollen adheres to it that it may or may not effect pollination; but when it is withdrawn wet with nectar, it is so well dusted with pollen that cross-pollination occurs when the bee visits another flower.

A list of the visitors is as follows:

BIRDS. *Trochilidae*: *Trochilus colubris* L.

HYMENOPTERA. APOIDEA. Long-tongued Bees—*Apidae*: *Apis mellifera* L. ♀. *Bombidae*: *Bombus vagans* Sm. ♀, *B. terricola* Say ♀, *B. ternarius*

¹ Blütenbiologie, Eng. Ed. Vol. III, page 242.

Say ♀, *Psithyrus laboriosus* Fab. ♀ ♂. *Euceridae*: *Melissodes agilis* var. *aurigena* Cr. ♂, *M. illata* Lov. & Ckll. ♀ ♂. *Epeolidae*: *Triepeolus donatus* Sm. ♀, *Epeolus pectoralis* Rob. ♀, *E.* sp. ♀. *Nomadidae*: *Nomada cuneata* Rob. ♀.

Short-tongued Bees—*Andrenidae*: *Andrena* sp. ♀. *Halictidae*: *Halictus lerouxii* Lep. ♀ ♂, *H. provancheri* D. T. ♀ ♂, *H. coriaceus* Sm. ♀ ♂, *H. pectoralis* Sm. ♀. *Panurgidae*: *Calliopsis andreniformis* Sm. ♀ ♂. *Prosopididae*: *Prosopis modesta* Say, ♀.

SPHECOIDEA. *Bembecidae*: *Bembex spinolae* Lep.

LEPIDOPTERA. *Nymphalidae*: *Argynnis aphrodite* Fab. *Lycaeidae*: *Colias philodicae* Godt.

DIPTERA. *Dexiidae*: *Rhyncodexia rufipennis* Macq. *Syrphidae*: *Eristalis transversus* Wiedl., *E. tenax* L., *Sphaerophoria cylindrica* Say. *Tachinidae*: *Echinomyia decisa* Walk.

HEMIPTERA. *Pentatomidae*: *Euschistus fissilis* Uhl.

The length of the corolla-tube is 3.7 mm., and of the pistil 2.5 mm., so that the distance between the anthers and the stigma is hardly more than 1 mm. Thus the tongues of many visiting insects can come in contact with them, though not long enough to reach the nectar. The anthers open widely fully exposing the pollen, a large amount of which is often found in old flowers deposited on the glutinous stigma. Three to ten flowers in each circle may be in bloom at the same time.

The ruby-throated humming-bird, the only species of this family of birds found in New England, is only an occasional visitor. The most important pollinator of the purple vervain in this locality is the honey-bee, which visits the flowers very rapidly, as in one instance, 53 visits were counted in one minute. It moves more often from right to left than in the opposite direction, approximately speaking in the ratio of 2 to 1, but seldom traveling around the entire circle before visiting another spike.

The other long-tongued bees are all able to suck the nectar, and thus effect cross-pollination. Worker bumblebees are the most common visitors of this group.

The tongues of most short-tongued bees, as in the genus *Halictus*, where the tongue varies in length from 1 to 1.5 mm., are unable to reach the nectar. Of 46 specimens of this genus collected, 39 were males, belonging to common species. Why so many males were present it is difficult to explain, though they fly only in summer and autumn when the purple vervain is in bloom.

Butterflies are occasionally present, but find the small flowers rather difficult to visit. Most anthophilous flies feed on pollen, as the species of *Syrphus* but they can not reach the nectar, as their tongues

are only two millimeters long, but *Eristallis tenax*, which has a proboscis 7–8 mm. in length, can easily do so. Both the *Dexiidae* and *Tachinidae* can reach the pollen.

Only one specimen of the order Hemiptera was collected. *Euschistus fissilis*, of the *Pentatomidae*, has a hard, 4-jointed beak more than 4 mm. long. It also sucks the juices of leaves and of caterpillars.

WALDOBORO, MAINE

ADDITIONAL NOTES ON *NAJAS* IN MINNESOTA

C. O. ROSENDAHL

At the time *Najas olivacea* was described¹ it was known from only one station in Minnesota; namely, Norway Lake, Kandiyohi County, in the south-central part of the state, where it was first found in the late summer of 1932. It was again collected at the same place in 1933, but all subsequent attempts to obtain additional material of the species from the type locality have proved fruitless. The apparently complete disappearance of the species from Norway Lake is perhaps to be accounted for by the extensive lowering of the lake level following the severe droughts that prevailed in 1934 and again in 1936. A part of the zone of mucky bottom on which the plant was found has now become exposed, and over the remainder the water has apparently been too shallow for it successfully to maintain itself. Several lakes of the surrounding territory, most of which have suffered less lowering of levels, have been diligently searched for possible additional stations, but uniformly without success. However, in the early summer of 1937, Mr. John B. Moyle, of the State Conservation Department, discovered the plant growing in great abundance in Snail Lake, situated near the middle of Ramsey County, approximately 5 miles north of the St. Paul city limits. The new station is approximately 100 miles east-southeast of Norway Lake. Its proximity to the Twin Cities has offered opportunity for a more intimate acquaintance with this quite distinct yet apparently long overlooked member of our *Najad* flora, and the following notes are presented in the hope that they may be of help to those who are on the lookout for the species in other parts of the country.

The plant grows on somewhat mucky lake bottoms, most profusely

¹ Rosendahl and Butters, *RHODORA* 37: 345. 1935.

at depths of about 1 meter. The stems attain lengths up to 40 cm. and are relatively stout, the lower internodes sometimes measuring 2 mm. in diameter in the living condition. The plants are very turgid, the leaves standing out stiffly, and the stems being so brittle that they break freely at the nodes in the process of collecting and handling.

In monographic and other systematic treatments the genus *Najas* is stated to consist of annual herbs. *N. olivacea* proves to be an exception to the rule since it renews freely from the persistent lower portions of the stems of the previous season. In greenhouse experiments Mr. Moyle has found that the plant propagates readily from the broken off, densely leafy tips of the vigorous vegetative shoots. It seems likely that in nature these shoot tips may act as hibernacula, but so far no direct observations in support of this view have been made.

Unlike the other species of *Najas* occurring within our range *N. olivacea* fruits very sparingly. The relatively few flowers that develop beyond the rudimentary stage are borne almost exclusively on the rather short (5-12 cm. long), first-formed shoots of the season's growth. Very rarely are fruits found on the more elongated, freely branching shoots that develop later. Generally the pistillate flowers are borne at the lower and the staminate at the upper nodes of the flowering shoots, but this is not invariably the rule, as fruits are sometimes found in the higher leaf axils. The quadrilocular anther is very plump, hence the staminate flowers are much more conspicuous in this species than in *N. flexilis*, which has a very slender and unilocular anther.

The pollen grains of *N. olivacea* are oblong-oval in outline (averaging $33 \times 62 \mu$), with finely granular contents, whereas in *N. flexilis* they are much more elongate (averaging $26 \times 82 \mu$) and coarsely granular. The pollen of *N. guadalupensis* is similar in shape to that of *N. olivacea* but slightly smaller ($27 \times 51 \mu$) and coarsely granular as in *N. flexilis*.

Extensive collecting of aquatic plants incident to a survey of Minnesota lakes by the State Conservation Department has resulted in considerable extension of the known ranges of all the *Najas* species occurring in the state. Thus, *N. marina*, which previously has been reported only from Big Stone and Pope Counties has now been found in Kandiyohi and Norway Lakes in Kandiyohi County and also in Maple Lake in Polk County, about 15 miles east of Crookston in the Red River Valley. The water in all the lakes where this species has

been collected is relatively high in dissolved carbonates and sulphates, but not to the extent of being brackish.

Najas gracillima, previously known only from a single small pond in Ramsey County has recently been collected in two additional widely separated localities, one of which is in Cook County in the extreme northeastern corner of the state, the other at the headwaters of the Mississippi River in Itasca Park.

Of *N. guadalupensis* only two earlier collections have been reported. Both of these were made about 40 years ago in the extreme southeastern part of the state. During the last two seasons the species has been collected in Hennepin, Freeborn, Martin, Renville, Yellow Medicine, Swift, Lac qui Parle, and Lincoln Counties. The known range of the species has accordingly been extended some 75 miles northward and clear across the southern third of the state to the South Dakota boundary.

UNIVERSITY OF MINNESOTA

SELENIA DISSECTA IN NEW MEXICO.—In a note in RHODORA for November, 1938, Mr. Robert F. Martin calls attention to the discovery of *Selenia dissecta* near Capitan, Lincoln County, New Mexico, April 12, 1929, by Mr. M. W. Talbot (now chief of range research, California Forest and Range Experiment Station). It seems worth while to record that the range plant herbarium of the U. S. Forest Service in Washington, D. C., contains four considerably earlier specimens of this crucifer collected in New Mexico as follows:

LINCOLN NATIONAL FOREST, OTERO COUNTY. (1) Mr. Joe A. Morgan's (a rancher) no. A-2 (Forest Service serial no. 31908). Collected March 15, 1919, at 4300 ft., sandy adobe soil. Sec. 32, T. 17 S., R. 10 E., Morgan's Ranch. Associated with *Euklisia valida* and *Sophia ochroleuca*.

In Mr. James T. Jardine's report on this specimen (prepared by myself) to the Regional Forester at Albuquerque, under date of January 5, 1920, this comment was made: "Apparently the first record of the occurrence of this species in the State of New Mexico; it is a rather little known species hitherto reported only from extreme western Texas near the New Mexico border."

JORNADA EXPERIMENTAL RANGE, DOÑA ANA COUNTY. (2) Paul B. Lister's no. 347 (Forest Service serial no. 42276). Collected February 28, 1923, at 4600 ft., in granitic soil. (3) Paul B. Lister's no. 361 (Forest Service serial no. 45874). Collected April 20, 1923, at

4300 ft. (4) J. D. Schoeller and R. S. Campbell's no. 503 (Forest Service no. 51402). Collected February 1, 1926, at 4300 ft. Associated with tobosa and burrograss.—W. A. DAYTON, Forest Service, Washington, D. C.

THE ASTER NOVAE-ANGLIAE, ASTER AMETHYSTINUS, ASTER MULTIFLORUS COMPLEX

RALPH H. WETMORE AND ALBERT L. DELISLE

In 1841,¹ Nuttall described and named *Aster amethystinus* from certain specimens found "in Massachusetts, near Cambridge and Salem, rare." This species was indicated as a "well marked and ornamental species, somewhat allied to *A. graveolens*, intimately to *A. novae-angliae*, but from which it is entirely distinct, the flowers not half the size, pale blue, very numerous, and disposed in a panicle, etc."

Suspicion of the possible hybrid nature of *A. amethystinus* was finally crystallized by Benke² in 1930. He epitomized the situation as follows, "The presence in close proximity of the two species before mentioned"—*A. novae-angliae* L. and *A. multiflorus* Ait.³—"in each case observed and the striking intermediate characteristics of the plant between the two furnish added circumstantial evidence that this charming aster may, with good reason, be regarded as a hybrid."

Later in the same year, Knowlton⁴ mentioned his experiences with this species in northwestern Massachusetts and southwestern Vermont, the site of Eggleston's original report of this species for Vermont. Here again he found both parents scattered around in "considerable profusion." His concluding sentence was pointed, "It would be a very interesting project for some botanical garden or experiment station to breed this interesting hybrid artificially for comparison with wild plants."

Further comments⁵ on the presumed hybrid nature of this species of *Aster* have been forthcoming from time to time. An examination of

¹ Trans. Am. Phil. Soc., ser. 2, 7: 294. 1841.

² RHODORA 32: 1-3. 1930.

³ The name *A. multiflorus* Ait. is used here because of its general occurrence in Gray's Manual, 7th ed., and other floras, instead of *A. ericoides* L. which, as Mackenzie and Blake point out, antedates it and under which the original description was made. Mackenzie, K. K. RHODORA 28: 65. 1926. Blake, S. F. RHODORA 32: 136-140. 1930.

⁴ RHODORA 32: 185-186. 1930.

⁵ Professor A. J. Eames reported to the senior author in a personal communication that he had produced *Aster amethystinus*-like plants experimentally by pollinating *A. multiflorus* stigmas with pollen from *A. novae-angliae*. He indicated that plants representing this cross are now in the herbarium at Cornell University.

the specimens found under this designation in the herbaria of the New England Botanical Club and in the Gray Herbarium brings out strikingly two points, (1) that the plants do combine the characters of the supposed parents, and (2) that they do so in every conceivable combination so that an almost graded series can be made from *A. novae-angliae*-like plants to those like *A. multiflorus*.

In the course of field, greenhouse and laboratory study of the genera *Aster* and *Solidago*, the senior author chose this species for genetical study in the hope of understanding something of the polymorphy present. The results of this work are appearing in considerable detail elsewhere.¹ The genetical work has been carried out by the junior author. Plants typifying the parents, crosses, backcrosses, etc. have been transplanted to the Harvard Botanic Garden, Cambridge. Pressed specimens have been placed in the Gray Herbarium.

The results of these studies may be summarized as follows:—

1. The two supposed parents, *A. novae-angliae* and *A. multiflorus* are self-sterile and reciprocally interfertile.

2. The F_1 hybrids are intermediate between the two parents and phenotypically rather uniform.

3. These F_1 plants are interfertile, providing a high percent of viable seed.

4. The F_2 population resulting is exceedingly variable, the characters studied not lending themselves to simple Mendelian analysis.

5. The backcrosses of the F_1 hybrids with the two parents give progenies which exhibit a polymorphy grading from the F_1 's to either parent.

6. A comparison of the forms produced in these genetic studies with those found in the collections of the Gray Herbarium and the Herbarium of the New England Botanical Club indicates that the natural variants can be matched with those genetically produced and that a preponderance of those obtained from Nature can be designated as backcrosses.

7. Utilizing a method suggested by Anderson² by which qualitative characters are converted into quantitative numerical values, statistical confirmation is provided for the above interpretation of this inter-specific variation.

8. Studies of chromosome numbers and chromosome morphology

¹ Wetmore, R. H. and A. L. Delisle, *Am. Jour. Bot.* 26: 1939.

² *Ann. Missouri Bot. Garden.* 23: 511-525. 1936.

in the parents, the F_1 's and the F_2 's and the backcrosses of known genetic origin give added support to the above interpretations.

9. A plotting of the distribution of the specimens of the two parents and of those interpreted as *A. amethystinus* Nutt. found in the Gray Herbarium indicates that both parents are found in the regions from which the hybrids have been reported.

The authors therefore confirm earlier opinions that *A. amethystinus* Nutt. includes forms which originated initially from crosses between *A. novae-angliae* L. and *A. multiflorus* Ait. Reports of plants belonging to the *A. amethystinus* complex have been infrequent. Obviously the parents must be reasonably close together if cross pollinations are to occur and F_1 's be produced. The laws of chance are, however, against F_1 's appearing very often in close geographical relation to one another. In consequence, it is likely that F_2 's would be even more rarely produced. However, since F_1 's ordinarily occur in proximity to one or both parents, backcrosses might be expected from time to time in the haphazard pollinations by insects. It is significant therefore that the variability of known genetic backcrosses in this complex accords in extent and in pattern with the forms collected in Nature.

The authors suggest therefore that, in highly polymorphic genera such as *Aster* and *Solidago*,¹ fortuitous hybridization followed by backcrossing must be considered as a possible contributing factor to interspecific variation.

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Harvard University

¹ Goodwin, R. H. RHODORA 38: 22-28, 1937.
——— Am. Jour. Bot. 24: 425-432, 1937.

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